THE ROYAL SOCIETY OF TASMANIA
THE ADVANCEMENT OF KNOWLEDGE

Papers and Proceedings of The Royal Society of Tasmania

Volume 155(2)
December 2021

IT'S SOMETHING... JUST A LITTLE SACRED SITE...
WE TRY NOT TO GO OVER THAT. WHERE THE BAD
1995 - AUNTY IDA WEST
THERE WAS A MASSACRE THERE, SAD THINGS
WE CAN ALWAYS MAKE IT GOOD"
IT'S PRETTY IMPORTANT YOU KNOW, THE LAND, IT DOESN'T
THERE BUT

THE ROYAL SOCIETY OF TASMANIA

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MUSEUMS VICTORIA
23 FEB 2021

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Edited by Dr Sally Bryant
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The Royal Society of Tasmania acknowledges, with deep respect, the traditional owners of this land, and the ongoing custodianship of the Aboriginal people of Tasmania. The Society pays respect to Elders past and present.

We acknowledge that Tasmanian Aboriginal Peoples have survived severe and unjust impacts resulting from invasion and dispossession of their Country.

As an institution dedicated to the advancement of knowledge, the Royal Society of Tasmania recognises Aboriginal cultural knowledge and practices and seeks to respect and honour these traditions and the deep understanding they represent.

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Cover photograph: *It's pretty important you know, the land, it doesn't matter how small, it's something … just a little sacred site … that's Wybalenna. There was a massacre there, sad things there but we try not to go over that. Where the bad was, we can always make it good".* 1995
Words of Aboriginal Elder Ida Amelia (Aunty Ida) West AM in the 'Aunty Ida West Healing Garden' at the Wybalenna Chapel, Flinders Island. (Photo: Sally Bryant)

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PAPERS AND PROCEEDINGS OF THE ROYAL SOCIETY OF TASMANIA

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Contents

page

Apology to Tasmanian Aboriginal people 2021 1

Rimmer, Z. & Taylor, R. The Report to inform an Apology to the Tasmanian Aboriginal Community by the Royal Society of Tasmania 13

Roe, M. Van Diemen's Land and the Great Exhibition of 1851 21

Sorensen, E.R. & Kirkpatrick, J.B. Vegetation change in an urban grassy woodland since the early nineteenth century 37

Baillie, P. S. Warren Carey: New Guinea oil explorer (1934–1942) 55

Baker, M.L., Grove, S., de Salas, M.F., Byrne, C., Cave, L., Bonham, K., Moore, K., Cook, L. & Kantvilas, G. Tasmanian Museum and Art Gallery's Expedition of Discovery II – The flora and fauna of Musselroe Wind Farm, Cape Portland, Northeast Tasmania 69

Ratcliff, E. Sheltering knowledge: residences of the Royal Society of Tasmania and its precursors, 1838 to 2021 ... 97

Husband, M. & Kirkpatrick, J.B. Effects of garden type and distance from bush on adventive trees in domestic gardens 111

Corbett, K.D. The geology and glacial history of the Walls of Jerusalem, Central Tasmania – a preliminary study ... 117

Kile, G.A. & Hall, M.F. Sporulating mycelium of *Davidsoniella australis* on the bark of *Nothofagus cunninghamii*, and role as inoculum for new infections 129

Henry, S.C. What's in a name? *Polyzosteria yingina*; the Golden Sun Cockroach 135

Baker, M.L., de Salas, M.F., Grove, S., Cave, L., Moore, K., Byrne, C., Lee, E. & Kantvilas, G. Tasmanian Museum and Art Gallery's Expedition of Discovery III – The flora and fauna of the Spring Bay Mill area after a long history of industrial use 139

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THE ROYAL SOCIETY OF TASMANIA

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The Royal Society of Tasmania

APOLOGY TO TASMANIAN ABORIGINAL PEOPLE 2021

On Monday, 15 February 2021, the Royal Society of Tasmania (RST) and the Tasmanian Museum and Art Gallery (TMAG) delivered paired Apologies to the Aboriginal people of Tasmania. The event was held in the Courtyard of TMAG, Hobart, and attended in person by about one hundred invited guests including members of the Tasmanian Aboriginal community, members of the Council of the RST and members of the Board of Trustees of TMAG. A large number of invited guests also witnessed the event by livestream. It was also the first time the Aboriginal flag had been flown at Customs House to commemorate the significance of this event.

The delivery of RST's Apology was the culmination of efforts that began in earnest at the end of 2019 when a first draft of the Apology was considered by RST Council. Co-Chairs of the Aboriginal Engagement Committee (AEC), Professor Greg Lehman and Professor Matt King, sought feedback on the draft Apology from the Aboriginal Advisory Council of the Tasmanian Museum and Art Gallery and the Aboriginal Reference Group of the Queen Victoria Museum and Art Gallery as well as the Council of the RST. The draft Apology was revised many times by members of the AEC until the final version crystallised in January 2021, a few weeks before the Apology was delivered.

TMAG was engaged in framing its Apology to Tasmanian Aboriginal people more-or-less at the same time, so the two organisations agreed to deliver paired apologies. A Joint Working Group comprising representatives from TMAG and RST was established in August 2020 and met almost weekly to put in place the plans required for the event. On the day of delivery, the COVID-19 pandemic restrictions regulated the number of people who could attend in person, with all others being accommodated via livestream.

The event began with Professor Matt King, Chair of the RST Aboriginal Engagement Committee, and Janet Carding, Director of TMAG, welcoming guests, presenting the Acknowledgment of Country on behalf of each of the two organisations and introducing the speakers. No media or government officials were invited, however, the Governor of Tasmania, Her Excellency the Honourable Professor Kate Warner AC, attended in her capacity as Patron of the RST and TMAG and was the first invited speaker.

For both the RST and TMAG, offering an Apology was a means of publicly acknowledging past actions and practices that have caused immense hurt and suffering to Tasmanian Aboriginal people. The Apologies signify the commitment of the two organisations to building strong and respectful relationships with Tasmanian Aboriginal people now and in the future.

Professor Matt King, Chair of the RST Aboriginal Engagement Committee, welcoming attendees. Photograph courtesy of Simon Cuthbert.

RST President, Mrs Mary Koolhof, delivering RST's Apology. Photograph courtesy of Jillian Mundy.

The RST and TMAG Apologies were paired in recognition of the shared history of the two organisations. That shared history began with the formation of the RST in 1843 and was explained in the Preamble presented by Her Excellency.

The second speaker was the President of RST, Mrs Mary Koolhof, who delivered RST's Apology to Tasmanian Aboriginal people. The Apology identified past negative practices including mistreatment and exhumation of Aboriginal ancestral remains and promised the beginning of a new era in the Society's relationship with Aboriginal people.

The Chair of the Board of Trustees of TMAG, Ms Brett Torossi, delivered TMAG's Apology to Tasmanian Aboriginal people. This Apology recognised the long history of profoundly hurtful practices including removal of cultural artifacts, and a commitment to re-dress past wrongs.

Director of TMAG, Ms Janet Carding (left) and Chair of TMAG Board of Trustees, Ms Brett Torossi, following the delivery of the TMAG Apology. Photograph courtesy of David Reilly.

Mr Rodney Gibbins, the first Chair of TMAG's Aboriginal Advisory Council, and Mr Michael Mansell, Chair of the Aboriginal Land Council of Tasmania, responded on behalf of Tasmanian Aboriginal people.

Rodney Gibbins began by mentioning some of the actions central to the discrimination and ill-treatment suffered by Tasmanian Aboriginal people following invasion, including the atrocities involving Aboriginal ancestral remains. He went on to explain that despite the obstacles, Tasmanian Aboriginal people have successfully campaigned for recognition, acceptance and autonomy. Attitudes and actions have gradually changed, including advances such as the recognition of land rights (1995) and the Apology to the 'stolen generation' (2004). He described the delivery of the Apologies as a significant step towards equality, justice and recognition of Tasmanian Aboriginal people and welcomed the opportunity to work in partnership with RST and TMAG.

Mr Michael Mansell brought to life the significance of the Preminghana petroglyphs in the lives of the Tasmanian Aboriginal people who created them. He regards the recent agreement reached with TMAG for the return of the petroglyphs as evidence of a new willingness to take responsibility for and acknowledge past mistakes, not just the modern mistakes but those made by all previous generations. Michael drew attention to the photographs of some Tasmanian Aboriginal 'Old People' on display, explaining that although the Apologies are being offered to the current generation, we must include the 'Old People' who suffered grievously. In his final words, Michael spoke for the 'Old People': "I stand here before you, on behalf of all those people, and readily accept with pride, the Apology that was given in the spirit in which it was stated".

In the audience, left to right foreground, Chair of TMAG Board of Trustees, Ms Brett Torossi, Ms Nala Mansell, Mr Rodney Gibbins and Mr Michael Mansell. In the background are members of the Tasmanian Aboriginal community holding historical photographs of Tasmanian Aboriginal people. Rodney Gibbins and Michael Mansell responded to the Apologies on behalf of Tasmanian Aboriginal people. Photograph courtesy of Jillian Mundy.

Mr Michael Mansell delivering his reply flanked by historical photographs held by members of the Tasmanian Aboriginal community. Photograph courtesy of Sally Bryant.

The formalities closed with a smoking ceremony, presided over by Jamie Graham-Blair and Auntie Wendal Pitchford. All attendees had the opportunity to be marked by ochre as a sign of belonging, and to be enveloped by the healing and cleansing smoke of the peppermint gum. Indigenous and traditional foods were then shared by all.

The Apology event can be viewed on https://youtube/ZRVwcS6DQW8 and a framed copy of the RST Apology is on display in the RST Lecture Room, TMAG. Permission has been given by the five key speakers for the transcripts of their speeches to follow this article.

Professor Jocelyn McPhie
RST Vice President 2021

During the smoking ceremony, Auntie Wendal Pitchford applying ochre to Her Excellency, the Honourable Professor Kate Warner AC, and Mr Richard Warner AM looking on. Photograph courtesy of Jillian Mundy.

Preamble

THE ROYAL SOCIETY OF TASMANIA AND TASMANIAN MUSEUM AND ART GALLERY APOLOGY TO TASMANIAN ABORIGINAL PEOPLE

delivered by Her Excellency Professor the Honourable Kate Warner AC, Governor of Tasmania

Thank you for inviting me to deliver a Preamble to the Apologies from the Royal Society of Tasmania and the Tasmanian Museum and Art Gallery.

There is important symbolism, I think, in the invitation to the Governor to perform this role today given the long association of this position with both organisations. Lieutenant Governors and then, after self-government, Governors have always been the Royal Society's President and more recently Patron. And from the earliest days the Governor has had a close relationship with the Tasmanian Museum and Art Gallery. For these reasons the island's Vice-Regal representative has been at least complicit in the Society's and the Museum's omissions and misdeeds and their consequences.

I will briefly explain the historical ties which makes it appropriate to pair these two Apologies.

The Royal Society of Tasmania (then of Van Diemen's Land) was founded in 1843 by Lieutenant Governor Sir John Eardley Wilmot with the aim of increasing knowledge, in particular knowledge about the island, and promoting research. For much of its history, the Governor, as President, attended and chaired its meetings. From the earliest days, the Society began building up collections of art and natural history specimens including Aboriginal artefacts and ancestral remains, all of which were housed in the Royal Society's Museum, the foundation stone of which was laid by Governor Sir Henry Fox Young in 1861.

In 1885 the Society relinquished the building and most of the collections to the people of Tasmania and the Tasmanian Museum was born, to become known as the Tasmanian Museum and Art Gallery after it opened a gallery wing four years later. Until 2017 the trustees of the Museum were required to present an annual report of the proceedings and progress of the Institution to the Governor and these reports included acquisitions.

The two organisations, while maintaining connections and some common membership of governing bodies – indeed the Museum's first Curator after it was transferred from the Royal Society was also the Secretary of the Royal Society, positions he held until 1907 – have had separate Acts of Parliament and separate boards of governance since 1885. The Royal Society is still based at TMAG, with an entrance in Davey Street.

It is important to note that these Apologies are not simply an apology for past actions, important as truth-telling is to acknowledge the devaluing of a culture that dates back at least 40,000 years, the acts of desecration and disrespect in relation to ancestral remains and cultural artefacts and the assertions of extinction and denial of survival of the Aboriginal people of lutruwita Tasmania.

These Apologies also look to the future with undertakings to change the narrative, to play an important role in communicating the cultural and spiritual significance of Country in the lives of our First Peoples of lutruwita/ Tasmania and in fostering the continuity of their culture; to make the respective institutions inclusive, respectful, equitable and welcoming to Tasmanian Aboriginal people and the Apologies embrace a commitment to playing a part in redressing the inequalities experienced by our First Peoples that the two organisations have contributed to.

And finally, as both organisations acknowledge, these Apologies are not given in the expectation of acceptance or receiving anything in return from the Tasmanian Aboriginal people. But they are intended to signal a commitment to a different and better future.

THE ROYAL SOCIETY OF TASMANIA
APOLOGY TO TASMANIAN ABORIGINAL PEOPLE

delivered by Mary Koolhof, President of The Royal Society of Tasmania

Today the Royal Society of Tasmania apologises unreservedly to the Aboriginal people of lutruwita (Tasmania).

This apology is long overdue.

The Royal Society of Tasmania recognises that it has been responsible for negative impacts on Tasmanian Aboriginal people in the past, and that these impacts contribute to the disadvantage, injustice and intergenerational trauma suffered today.

The Council of the Royal Society of Tasmania, on behalf of its membership, offers this sincere and formal apology to the Aboriginal people of lutruwita (Tasmania).

We acknowledge that:

The Society acted to exhume and to purchase the ancestral remains of Tasmanian Aboriginal people for scientific study. In some cases these remains were sent to collecting institutions outside of Tasmania.

Exhumation and mistreatment of ancestral remains occurred with a lack of regard for their deep cultural and spiritual significance. In at least one case, exhumation was against the expressed wish of the individual concerned.

These remains were held by the Society in the Royal Society Museum without care or respect, and without discussion or permission from Aboriginal community members.

For this, we are sorry.

Research and interpretation of Tasmanian Aboriginal material culture, language and cultural knowledge were undertaken without consultation or due respect.

For this, we are sorry.

While sometimes advocating for the recognition of the importance of Tasmanian Aboriginal culture, the Society at times failed to challenge prevailing attitudes that denied recognition and respect for Tasmanian Aboriginal people.

Past practices of collection, description and representation of Tasmanian Aboriginal people and their material culture by the Society contributed to beliefs that continue to be misleading and destructive.

For this, we are sorry.

The Society failed to respond to a past request to support a proposal for a treaty with Tasmanian Aboriginal people.

Actions of some members of the Society, who were also leaders in the Tasmanian community, legitimised and facilitated the mistreatment of Tasmanian Aboriginal people and their material culture.

Some members of the Society actively opposed requests for the return of ancestral remains to Aboriginal people.

For all this, we are sorry. We are unreservedly sorry.

Now we look to the future.

The Royal Society of Tasmania understands that this apology must influence all aspects of its undertakings in seeking the advancement of knowledge.

We intend to to work co-operatively and respectfully with Tasmanian Aboriginal people on meaningful and lasting initiatives.

We will work to respect the values and perspectives of Tasmanian Aboriginal people, and understand and acknowledge protocols and processes determined by Aboriginal people.

We will seek a truthful and full account of the actions of the Society and its members that fully recognises impacts on Aboriginal people for which we take responsibility.

We will promote ethical research-related scholarly activities in consultation with, and of benefit to Tasmanian Aboriginal people.

We will support Tasmanian Aboriginal people in seeking the repatriation of their ancestral remains and material culture.

Finally, we hope that the delivery of this apology today will mark the beginning of a new era, and a relationship that recognises the histories, cultures, knowledge and aspirations of Tasmanian Aboriginal people as fundamental to the future of Tasmanian society.

Resolution of the Council of the Royal Society of Tasmania
22 September 2020

Mary Koolhof, President
15 February 2021

TASMANIAN MUSEUM AND ART GALLERY APOLOGY TO TASMANIAN ABORIGINAL PEOPLE

delivered by Brett Torossi
Chair of the Board of Trustees of the Tasmanian Museum and Art Gallery

We are here today on the lands of Tasmanian Aboriginal people, the traditional owners and custodians of the land and waterways of *lutruwita* (Tasmania). We wish to pay our deepest respects to Tasmanian Aboriginal people, and Elders past and present. The Tasmanian Museum and Art Gallery sits on the land of the *Muwinina* and *Mumirimina* people, who once lived in the Hobart region. We wish to pay our respects to all of these people, and acknowledge their sovereignties in land and sea, never ceded.

To belong to a place for tens of thousands of years is something non-Aboriginal Tasmanians are only beginning to comprehend. We acknowledge the beauty of this land and the way the river upon which we live, and *kunanyi* that watches over us here in Hobart, have shaped our lives and the lives of all who have come before us. We see that belonging lives at the heart of responsibility and connection.

Today we find the courage to take responsibility for the past. Today we own our actions and culture that have caused such pain to Aboriginal Tasmanians. This is a moment long overdue.

Today is therefore a day of enormous importance and gravity. Today we, the Tasmanian Museum and Art Gallery, apologise to Tasmanian Aboriginal people for nearly 200 years of practices that we acknowledge were morally wrong.

For many years Tasmanian Aboriginal people have called for the Tasmanian Museum and Art Gallery to tell the truth about its part in a difficult and traumatic past. We cannot move forward together without truth telling, without addressing the past, and the previous museum practices that have caused profound suffering for Aboriginal people and their community.

On behalf of the whole organisation, the Board wants to acknowledge openly, permanently record, and apologise for the institution's actions and declare that such behaviour will never happen again.

The Tasmanian Museum and Art Gallery, its precursor the Royal Society Museum and people in a variety of roles associated with these institutions, were part of, and sometimes were deeply implicated in, acts which were heedless of, or knowingly contrary to, the wishes and cultural practices of Tasmanian Aboriginal people. These injustices, and the consequences for Tasmanian Aboriginal people must be owned and acknowledged not simply as facts of history but with our hearts and our minds.

Beginning in 1803, the violence of European invasion and colonisation began a process of loss and dispossession for Tasmanian Aboriginal people across *lutruwita*. During this time, from the very beginnings of colonisation, the Tasmanian Museum and Art Gallery, and its former entity The Royal Society Museum, participated in practices, including the digging up and removal, the collection, and the trade of, ancestral remains of Tasmanian Aboriginal people (or respectfully, the Old People.) This was done largely in the name of racial sciences – practices of ethnography and anthropology which were racist, discriminatory, and have long been entirely discredited.

These practices showed profound disrespect for Aboriginal people, their families and communities, and their vital spiritual and cultural practices. The remains of Aboriginal people were exploited as artefacts and objects of research, their burial sites were violated, and the importance of Aboriginal spiritual beliefs and cultural heritage were ignored, trivialised and dismissed. There is ample, undisputed evidence of this. Aboriginal people have known this. Members of the Tasmanian Museum and Art Gallery, its former directors, and staff have known this. The evidence is in the minutes of the institution itself, in reports, in letters, diaries, and in newspapers – it is on the public record. But it has also been hidden and forgotten, and too often denied. We know Tasmanian Aboriginal people do not forget that this is what has occurred.

It is well documented that staff, and those associated with the Tasmanian Museum and Art Gallery, solicited and paid for the removal of Tasmanian Aboriginal ancestral remains for collection and trade, and used ancestral remains and material culture in museum and scientific exchanges across the nation and around the globe.

It is beyond dispute that the Tasmanian Museum and Art Gallery disrespected the remains of *Trukanini*. It created public displays and interpretation of her remains. Her wish to be buried in the D'Entrecasteaux Channel, so her body could not be cut up, was disregarded. If we imagine such a practise being enacted on our own grandmother, if we imagine the burial sites of our loved ones being dug up, and their bones being traded and used for scientific research, or put on show in museums and galleries across the world, we begin to understand the appalling hurt our predecessors caused the Aboriginal people.

There was also resistance to the repatriation of Tasmanian Aboriginal ancestral remains back to *lutruwita* so that the Old People might rest again in the earth of their homeland. It is amply clear that the Board of the Tasmanian Museum and Art Gallery did not fully respect the Tasmanian Aboriginal Community's wishes to actively engage and find appropriate ways to repatriate the remains of loved ones. There was a lack of active engagement to enable community requests, and legal codes and bureaucracy were too often used as a shield and an excuse.

Ancient cultural artefacts of spiritual and ceremonial value were removed without consultation with Tasmanian Aboriginal people. The removal of the *Preminghana* petroglyphs from the West Coast in the 1960s is a key example of such past practices.

The Tasmanian Museum and Art Gallery created inappropriate displays and exhibitions concerning Tasmanian Aboriginal people, and promulgated false ideas of 'extinction'; that is, that there were no Aborigines in Tasmania after *Trukanini*.

For much of its history, the institution did not recognise or respect the deep, continuing knowledge of Tasmanian Aboriginal people, and did not ask them to be the curators of their cultural material held in the collections, or to tell their stories.

We acknowledge that all of these actions have been damaging to Tasmanian Aboriginal people and to the Community. We acknowledge and own the pain we have caused.

As a museum in the European tradition, we also traded in the remains of the ancestors of other nations, and brought them to this Country. We acknowledge the insensitivity and disrespect shown by these practices to Tasmanian Aboriginal people and to the peoples of other cultures and lands.

It is heartbreaking to consider the trauma inflicted on Aboriginal people by all these practices, trauma that echoes down through time, and cannot begin to be healed without full and fearless recognition.

For all of these actions and for your pain, suffering and ongoing trauma, we, the Board of the Tasmanian Museum and Art Gallery, are truly and completely sorry. Although words can never erase the actions of the past, they have a permanence and potency. We know we have caused heartbreak, and we acknowledge this honestly.

We understand that some Tasmanian Aboriginal people may not wish to accept our apology; indeed some may reject it.

We want to build trust with you – without ever forgetting the past. We want to find a future way of being together that is open-minded and whole-hearted. We understand that this may be hard, and difficult emotional business for Tasmanian Aboriginal people, and it requires trust where there has been none.

We offer and hope that this apology will be received in the spirit that it is given. We give it unreservedly without asking for anything. We know and mourn that it is so belated.

The Tasmanian Museum and Art Gallery commits to changing our practices. We commit to creating a shared and consultative vision – based on respect and good faith – to tell the rich, varied and difficult story of this island. While new ways of working do not make up for the past, we want this to be the beginning of a new relationship. We want the Tasmanian Museum and Art Gallery to be a safe place for Tasmanian Aboriginal people in the future.

The Tasmanian Museum and Art Gallery has supported repatriation programs over the last thirty years and, through knowledge shared by Aboriginal people, we have learned to better respect Tasmanian ancestral remains, and secret-sacred heritage materials.

Through participation in the creation and development of the Aboriginal Advisory Council, Aboriginal people have engaged with us and have helped guide the organisation. We wish to acknowledge the bravery and trust of the earliest members of the Tasmanian Aboriginal Advisory Council who paved the way for a new direction, giving us a keen awareness of what could be possible for the future.

Tasmanian Aboriginal people have been appointed to roles within the museum, which has helped to improve truth telling and respectful treatment, display and interpretation of cultural heritage.

Since 2003, learning and exchange have deepened. Through Aboriginal-led exhibitions and projects, such as *ningina tunapri* and, later, *parrawa*, *tayenebe* and *kanalaritja*, we have taken positive steps and have jointly fostered and supported new and more respectful ways of working.

These positive steps do not in any way offset, or make-up for, the injustices and practices of the past.

We have made the decision to repatriate the *Preminghana* petroglyphs, and we will continue to work with the Community to complete that process.

We have committed to working alongside museums and galleries around Australia to enhance engagement with all First Peoples by implementing the Australian Museums and Galleries Association Indigenous Roadmap.

We want today, and every day forward, to do better. Through speaking the truth, we wish to make visible and real the past that haunts this institution so that a new way of seeing and living in community together is possible.

On 29 May 2017, over three years ago, the Uluru Statement from the Heart was delivered by the First Nations National Constitutional Convention to the Australian people. The Aboriginal writers of the statement placed matters of history and truth telling, of Aboriginal sovereignty and power, at the very forefront of agreement making. All over this nation, and on this island of *lutruwita*, Aboriginal people have called for truth telling about the difficult past and its ongoing damaging legacies that continue today.

We commit to a different future working with you to ensure we:

- Recognise the right to self-determination of all First Peoples
- Recognise that the Tasmanian Museum and Art Gallery is the custodian of art and cultural material that are owned and stewarded in perpetuity by First Peoples around the world
- Recognise that the Tasmanian Museum and Art Gallery is the custodian of contemporary art and cultural materials purchased from First Peoples around the world
- Acknowledge Country at all Tasmanian Museum and Art Gallery sites and online, and ensure Tasmanian Aboriginal Community presence is always and obviously manifest
- Listen deeply to, and learn with, Tasmanian Aboriginal people, respecting the cultural knowledge and spiritual values of the Aboriginal Community

- Work as a facilitator with the Aboriginal Community in Tasmania on projects and initiatives that tell First Peoples' stories
- Work in partnership with the Community in all our work, and using our exhibitions, programs, research capacity and the resources of the State Collection to tell the truth about Tasmania's history of colonisation and the contemporary resilience of Tasmanian Aboriginal people
- Ensure cultural safety for First Peoples staff, volunteers and visitors by improving cultural competence of the Board, staff and volunteers
- Review and revise Tasmanian Museum and Art Gallery policies so they are culturally appropriate, and implement new protocols for how First Peoples are welcomed and included
- Work to share access to First Peoples material(s) held at the Tasmanian Museum and Art Gallery with communities across Australia and overseas, and support repatriation when return is requested
- Take a leadership role, as the State museum and gallery, in encouraging the adoption of culturally appropriate policies and practices by museums and galleries across Tasmania and Australia
- Embed these practices in the governance and leadership of the Tasmanian Museum and Art Gallery
- Never forget our shared past or the long history of Tasmanian Aboriginal people and *lutruwita* (Tasmania).

In conclusion, in the year of 2021, the Board of the Tasmanian Museum and Art Gallery on behalf of the whole organisation, wants to openly and whole heartedly acknowledge, permanently record, and deeply apologise for the institution's past actions relating to the Tasmanian Aboriginal people.

This Apology will be displayed, here and online, as a permanent record to reinforce this commitment.

In offering these words today, we take full responsibility for all that has kept us apart. I am sorry. We are sorry.

We seek a new way of cultivating engagement, enriching understanding, and warmly embracing respectful partnership with Tasmanian Aboriginal people. We commit, now and always, to a future that defends, sustains and illuminates Tasmanian Aboriginal culture here at the Tasmanian Museum and Art Gallery and throughout Tasmanian life.

We mark this occasion, and the enduring nature of our apology and our commitment, with this public statement and hope that today marks a more honest way of being with the past and a new sense of responsibility and belonging to this beautiful island for all who call it home.

Thank you everyone for your attendance on this important occasion.

REPLY TO THE APOLOGY TO THE ABORIGINAL COMMUNITY BY THE ROYAL SOCIETY OF TASMANIA AND THE TASMANIAN MUSEUM AND ART GALLERY

delivered by Mr Rodney Gibbins

Good afternoon everyone. I would like to acknowledge all members of the Tasmanian Aboriginal community who are here today, and to pay respect to all our old people who have passed before us. Let's not forget that this day is as much about them as it is us.

This is a momentous day for the Aboriginal community of Tasmania – Tasmanian Museum and Art Gallery and the Royal Society of Tasmania.

As we have heard today the TMAG and the Royal Society have offered apologies to the Aboriginal community for past actions that have shown no regard for our culture and spirituality and which in turn contributed to our disadvantage and trauma.

I believe it is up to all of us to consider these apologies with open minds and hearts.

Over the years, the Tasmanian Aboriginal community has had its issues not only with TMAG but with various Tasmanian Governments and their broader institutions. There was a reluctance on the part of Government and its institutions to rethink and remake old ill-informed attitudes towards the Aboriginal community. These views have profoundly contributed to the continued disadvantage of the Aboriginal community and have impacted on our rights, aspirations and identity.

These actions and attitudes are long standing.

For example, the return of the remains of Truganini who died in 1876. Her wish to be buried beyond the mountains were ignored. Truganini's greatest fear was to suffer the same fate as William Lanne. Upon his death in 1869, his remains were fought over and then mutilated by William Crowther of the Royal College of Surgeons and George Stockell a member of the Royal Society of Tasmania.

Truganini was buried in the grounds of the former Female Factory in South Hobart only to be dug up two years later, by members of the Royal Society and have her skeleton placed on display at the TMAG for over 40 years. Even though the Aboriginal community campaigned to have her returned it was the Government who decided the timing of her return. It decided she would be cremated at Cornelian Bay on the 100th anniversary of her death. There were no members of the Aboriginal community present. Her ashes were then scattered in the D'Entrecasteaux Channel by the small number of Aborigines present.

Again, there was the reluctance of the museum and Government to hand over the Aboriginal human remains removed from Putalina (Oyster Cove) – the so-called Crowther collection – to the Aboriginal community. That was combined with the hesitation of the TMAG to change the old diorama which was a 3D representation of a family group at camp in front of a stolen petroglyph from Preminghana. A display that was naïve and inappropriate and didn't recognise continued Aboriginal Sovereignty over this land. This persisted from the 1960s to the late 1990s

At that same time changes were happening in the Aboriginal community. There was a growing political and social movement within the Aboriginal community that demanded recognition, acceptance and autonomy. The community built its political knowledge and skills. After launching effective campaigns, using the media and influencing public opinion the views and attitudes of Government and its institutions along with those of the broader community began to change.

This has been one of our greatest achievements.

Our political skills and ability to influence attitudinal change have had significant outcomes. In 1985 this led to the Crowther collection of Aboriginal remains consisting of 33 skulls and three skeletons being released to the Aboriginal community under its terms and control. This led to one of the largest gathering of Aborigines at Putalina to welcome our old people home with our own spiritual and ceremonial practices that set their spirits free at last.

The winds of change were also influencing TMAG. There were new people with new ideas. Pat Sabine, a former director of the TMAG during the 1990s, bought with her a genuine concern about how Aborigines were portrayed and represented in the museum. She consistently advocated for the development of a more contemporary and honest portrayal of the Tasmanian Aboriginal community.

Through her persistence, a trainee Tasmanian Aboriginal curator position was created. Tony Brown was selected to take up that position and, after successfully completing a degree at the University of Tasmania, became the museum's first full-time Aboriginal Curator of Indigenous Cultures in 1997.

Perhaps, for the first time TMAG began to support and learn about reconciliation, and truth telling about Aboriginal experiences past and present. It deepened and made a more genuine partnership with the Aboriginal community. These changes progressed under the leadership of Bill Bleathman, which saw Zoe Rimmer successfully complete a degree at the University of Tasmania. Zoe is now TMAG's Senior Indigenous Cultures Curator after the retirement of Tony.

During this time a new display was being developed, the much visited and applauded Aboriginal gallery, Ningenneh Tunapry. It offered for the first time a comprehensive account of Aboriginal history with a vast array of Aboriginal Cultural expression. The Gallery was shaped by the

Aboriginal community – and reflects the thoughts and aspirations of that community. Community consultations were undertaken around the State to ensure relevant and critical issues of interest to the Aboriginal community were included.

Ningenneh Tunapry, means to "Give Knowledge and Understanding". The guiding principle of the project is to provide learning experience. One aim is to prompt non-Aborigines to rethink their attitudes, their actions and their impacts on the Aboriginal community.

Another exhibition was developed to complement Ningenneh Tunapry. This was the Parrawar Parrawar exhibition about the conflict between Tasmanian Aborigines and the Colonial invaders. I believe one of the first of these types of exhibitions to be developed anywhere in Australia. It was a difficult story to tell one of violence and dispossession. It gave visitors an experience of conflict, particularly from the Aboriginal perspective, which has been rarely told. It was an explicit story of invasion characterised by conflict over the use and control of land and its resources.

It has been our experience in Tasmania that it has been a personal commitment by political and bureaucratic leaders that has delivered crucial advances in Aboriginal Affairs. I acknowledge the leadership of former Premier Ray Groom (on a personal note one of the most honourable men I've known) who in the mid 90s introduced land rights legislation to Parliament. He consulted exhaustively across the State and when the Legislation was presented to Parliament it faced no opposition at all.

The Jim Bacon and Paul Lennon Labor Governments were equally effective in broad consultations that led to the hand back of Wybalenna, Cape Barren, and the Parliamentary apology to the Stolen generation.

Today the Tasmanian Museum and Art Gallery should be complimented for steady progress it has made in its outlook and support for the Aboriginal Community's aspirations leading up to today's apology. The representation of Aboriginal people is now characterised by respect and engagement with the Community. Today's apology is not only an acknowledgement of past wrongs but a pledge to equal and respectful partnerships in the future.

Of course, there is always room for further improvements. And we must closely guard these advances that we have fought so hard to achieve within TMAG, and within our political process and across the State. The winds of change have a habit of retreating.

I fear that since Will Hodgeman's 2016 ill-informed Australia day speech the current Liberal Government is eroding the advances made by the Aboriginal community. It is eating away at Aboriginal influence and knowledge by limiting the number of consultations with Aborigines and some non-Aborigines to a select few severely reducing broad Aboriginal Community consultations.

This is more about meeting the personal desires and ambitions of the few rather than meeting with the broad Aboriginal community and understanding their needs and aspirations. The cost of these actions are being paid for by the rest of the Aboriginal community through living with inequitable, and even discriminatory decisions being made by the Tasmanian Government. These actions fly in the face of the advances made by previous governments and their institutions, such as TMAG, over the past years in developing a strong consultative relationship with the Aboriginal community.

Today I recognise the humility shown by the Tasmanian Museum and Art Gallery and the Royal Society of Tasmania to offer their apologies. I thank them for their promise of a strong consultative relationship with the Aboriginal community into the future.

Our story – the story of the Tasmanian Aboriginal community – has been one of struggle and denial. Despite the many obstacles put in front of us we have survived and prospered. We will continue our quest for equality, justice and recognition. Today marks a significant step in that quest.

Thank you.

REPLY TO THE APOLOGY TO THE ABORIGINAL COMMUNITY BY THE ROYAL SOCIETY OF TASMANIA AND THE TASMANIAN MUSEUM AND ART GALLERY

delivered by Mr Michael Mansell

The speakers I am to follow delivered four very powerful speeches. [Michael then acknowledges the protocol for addressing the Governor Kate Warner].

Of course, the catalyst for this event was the request by the Aboriginal community for the return the petroglyphs to the place from which they were taken, and agreement by TMAG to hand the petroglyphs over.

Over the years there has been much ignorance about what the petroglyphs mean. Most people ponder what exactly each design means. But it doesn't take much to work out that a people who lived for thousands and thousands of years on this earth, would note down, like every society in the world, the things that were important to the lifestyle and the events that took place in their lives. The significant events that they saw, whether they were in the sky, whether they were in a corroboree, whether they were of a great warrior whose name was no longer allowed to be used for so many generations, and that warrior's name was an emblem of an animal, all those things are in the rock carvings. When there was some significant corroboree event from a visiting tribal group or from a great distance where gifts were exchanged, and relationships made or cemented, are all in the rock carvings. And so when people say 'well we don't know what they mean', we might not know exactly what each circle or what each line means, but we know the overall context for the markings honoring many thousands of years.

The water rose, the scientists tell us, 6000 years ago. That being so, many records of ancient events are now underwater on the west coast and probably elsewhere. What we are seeing in 2021, is just the little bits that remain unconcealed. It is important to acknowledge those people who, over generations and generations over thousands of years, carved into rock, events that they had seen or heard about and wanted to leave there for prosperity. For whom were these records meant to be left to?

Those records were not intended to be cut away and taken away to white people's museums. The people who carved them had never seen white people. They could not have known that their sacred works would be taken away. It is absolutely significant that the Tasmanian Museum and Art Gallery, without any hesitation said 'okay' you want them back in their rightful place – we'll give them back. No prompting, no coercion, done in the best of faith. An important gesture on the part of the Museum to do it so quickly.

Many representatives of institutions apologise for actions their forebears did and leave it at that. And you can understand that. "We didn't take the land, we didn't cut up the people when they were dead, we're sorry about that, but you know we're sorry really about these things that we've done in more recent times". But what I heard in those speeches was from Mary – ownership, of all the things that that the Royal Society did. From Brett – responsibility for all of the things, not just in recent times, that TMAG have been involved in. The succinct summary by the Governor Kate Warner – pulled it together, about the impact of things done on Aboriginal people, not just on Aboriginal people but also how those things diminished white society too. We heard about the attitudes and behavior of a society who were invaded, exiled to the Bass Strait islands and their descendants sidelined without rights or remedies.

So, I think it is important for we Aborigines to acknowledge that the institutions did not shy from the activities of their predecessors – they acknowledged the issues that we have complained about over the years. They have acknowledged the wrong of those activities and they have taken responsibility, not only for acknowledging and identifying them, but saying "we have to do it better" – and that's an important part of any apology.

When we look at even more recent time in the 1900s, I'm still amazed at when *Truganina's* remains were displayed in this Museum, why some of the people – not a single soul thought to talk to the people who were directly affected. The Museum in those days – in the 1930s – could not have said "we don't know any Aborigines in Tasmania", because they had the recording of Fanny Cochrane Smith here in the Museum itself. When, in 1949, the Queen Victoria Museum and Art Gallery in Launceston took its first collection of the petroglyphs from Preminghana, they must have known that Aboriginal people had been 'forced' from the islands under the Tasmanian Government's assimilation program, and dumped mostly in the slum housing in Invermay, which was just five minutes' walk from the QV Museum. How blind can people be? Still, no one bothered to consult those Aboriginal people so nearby!

So it brings us to the question of 'if the Apology is coming from the institutions, not just in this current generation, not just on behalf of this Board, not just on behalf of the staff, not just on behalf of the leadership now, but they own – embrace – and take responsibility – for all of the mistakes that have been made by those institutions, way back until the time they established themselves here in Tasmania, To whom then is the apology addressed from TMAG, the Royal Society and the Governor on behalf of Tasmanian society? It cannot be to me, or any other individual. If the mistakes of generations gone are acknowledged and an apology given, then those apologies

are addressed to those people at Wybalenna whose images we see on the banner [Michael points to a banner held up by Aboriginal people]. They were the ones who lived with *Truganina* and William Lanny. They were the ones who grew up with them, who knew them. The next generation on the other banner over there [Michael points to another banner near Sarah Maynard] Lucy Beaton, Nancy Mansell, Jack Maynard, Philip Thomas in front and Harry Beaton on the end. They wrote the 1883 petition to the local newspaper in Launceston:

> *We are under no obligation to the Government. Whatever land they have reserved for our use, is a token of their honesty. In as much as it has been given in lieu of that grand island Tasmania, which they have taken from our ancestors.*

They knew about morals, about right and wrong. Unsurprisingly, at the bottom of the letter the newspaper saw fit to add "we do not identify ourselves with the opinions of the correspondents". So, how's that!

In 1911, Gov. Warner's predecessor visited Cape Barren as a forerunner to the Cape Barren Island Reserve Act 1912. Aboriginal people thought they were getting legislated land rights. They believed they were getting the whole of Cape Barren, the mutton bird islands and other islands, as a sanctuary against assimilation enforcement.

In 1911, Aboriginal people from all around the islands came to Cape Barren to meet the Governor believing he would be giving Cape Barren to Aboriginal people. They were deceived. Out of the intended land rights for Aboriginal people, they were given blocks of land that they had to fence, and they had to behave like white people, otherwise they would lose any plots of land. Any Aboriginal woman who married a white man was not allowed to stay on the reserve. Some Aboriginal people, closely related to Aborigines on Cape Barren, were kicked off the island after dark, and were not allowed to stay with their people. So, I say the apology is also directed to them. Ray Groom took responsibility for dispossession in the 1990s by beginning the process of land return. Mr Groom's gesture was to those people in the past but also to us, the contemporary Aboriginal people. It was an important act of recognition.

Those who have delivered the apologies today on behalf of their institutions also have made an important acknowledgement of the hurt to we Aborigines of today.

In return, I stand here before you and say "on behalf of all of those Aboriginal generations I have mentioned, we readily accept, with pride, the apologies given, in the spirit within which it was stated".

Thank you.

THE REPORT TO INFORM AN APOLOGY TO THE TASMANIAN ABORIGINAL COMMUNITY BY THE ROYAL SOCIETY OF TASMANIA

by Zoe Rimmer and Rebe Taylor

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CULTURAL WARNING

This paper contains information regarding Aboriginal Ancestral remains that may cause sadness, anger and distress to some people. This information is being shared in the spirit of truth-telling and with the understanding that with knowledge comes obligations. We ask that you treat the information in this paper with dignity and respect to Aboriginal Community members and their wishes about how these stories should be shared.

In 2017, the Royal Society of Tasmania (the Society) commissioned a report to inform an apology to the Tasmanian Aboriginal Community. Pakana woman and museum curator Zoe Rimmer and British-born historian Rebe Taylor co-researched and wrote the Report by early 2018. The Report detailed mistreatment of Tasmanian Aboriginal Ancestral remains and mistreatment and misrepresentation of Tasmanian Aboriginal culture and people. The Society presented its Apology in February 2021 at an event at the Tasmanian Museum and Art Gallery (TMAG). The Society's Apology was preceded by a Preamble by Tasmania's Governor and was followed by a 'paired' Apology by TMAG. This paper includes all the findings and recommendations included in the original report and differs only in its formatting, style, and some very minor editing.
Key Words: Tasmanian Aboriginal Community, Apology, Royal Society of Tasmania, Tasmanian Museum and Art Gallery.

BACKGROUND

In 2017, the Royal Society of Tasmania commissioned historian Rebe Taylor to write a report to inform a planned Apology to the Tasmanian Aboriginal (Pakana) Community. Due to Zoe Rimmer's comprehensive knowledge of the history and records pertaining to the removals and repatriations of Tasmanian Aboriginal cultural artefacts and Ancestral remains, the Society agreed that the Report be co-authored by Rimmer and Taylor.

Rimmer and Taylor began by considering the Report's potential scope. They observed that historians Stefan Petrow (1997), Tom Wise (2003), Helen MacDonald (2005), Tom Lawson (2014) and Paul Turnbull (2017) had detailed variously the theft, mistreatment and trade of Tasmanian Aboriginal Ancestral remains by Society members (and others) in the nineteenth century. Less examined, however, was the continued removal of Ancestral remains from Country during the twentieth century and the resistance to demands by the Aboriginal Community to repatriate Ancestors made from the 1970s (references in the below report). The authors also noted that there had been less historical research on the theft and mistreatment of Tasmanian Aboriginal material culture relative to that of Ancestral remains through both the nineteenth and twentieth centuries.

The Report was intended as an overview. The authors recognise that there exists more historical detail than can be included in a relatively short report. The below reproduction of our Report includes all the findings and recommendations included in its original form and differs only in its formatting, style, and very minor editing (except for point three below, that has been reworked to explain the governance relationship between TMAG and the Society). The Report opens with six key points that preface and direct its findings followed by two main parts: the 'Mistreatment of Tasmanian Aboriginal Ancestral remains' and the 'Mistreatment of Tasmanian Aboriginal material artefacts'. A short closing statement considers the misrepresentations of Tasmanian Aboriginal people and culture.

THE REPORT TO INFORM AN APOLOGY TO THE TASMANIAN ABORIGINAL COMMUNITY BY THE ROYAL SOCIETY OF TASMANIA BY ZOE RIMMER AND REBE TAYLOR, 2018

Six key points preface and direct the findings of this Report.

First: From its inception in 1843, the Royal Society's members have included leaders in Tasmanian politics, law, education, church, and industry since its formation (Wise 2003). The members' social standing has legitimated and facilitated the mistreatment of Tasmanian Aboriginal people and material culture from the mid nineteenth century. An apology by the Society should acknowledge its failure to lead their community with honourable and decent conduct.

Second: The Society's mistreatment of Tasmanian Aboriginal bodies and material culture followed the forced dispossession of Aboriginal lands and removal of Aboriginal children, Ancestral remains and cultural objects. An apology by the Society should recognise that their mistreatment of

Tasmanian Aboriginal bodies and material culture was part of the wider history of invasion and colonisation.

Third: The Royal Society Museum was established in 1846 by the Society. In 1885, the Society vested its collections, including Aboriginal Ancestral remains and cultural objects, in the new and public Tasmanian Museum (shortly thereafter the Tasmanian Museum and Art Gallery) by an Act of Parliament (*An Act to incorporate and endow the Tasmanian Museum and Botanical Gardens No. 34 1885*, Tasmania). While formally separated by law, the Society and TMAG, remained 'united in aims and services' (Somerville 1944). The TMAG Board maintained a majority of Society Councillors through most of the twentieth century. Until 1993, the TMAG Director was also Secretary of the Society. In 2021, in accordance with the *Tasmanian Museum and Art Gallery Act 2017*, the TMAG Board is appointed by the responsible State Government Minister who is 'to consult and seek nominations from the Royal Society of Tasmania'. The TMAG Director holds *ex-officio* membership of the Society's Council. The Society is located at TMAG and the two institutions continue occasionally to collaborate. However, the Society remains a non-government member-based organisation while TMAG reports to the Tasmanian State Government's Department of State Growth. In relation to Tasmanian Aboriginal Ancestral remains and cultural artefacts, the majority of acquisitions and the most serious mistreatments occurred when those collections were either managed by the Society Museum or by TMAG during the time the TMAG Board was dominated in numbers by Society members and the TMAG Director also held the role of Society Secretary. In the eyes of the Tasmanian public, including the Tasmanian Aboriginal Community, there has been no clear distinction between the Society and Museum. An apology by the Society to Tasmanian Aborigines should incorporate TMAG. The authors therefore direct the following three points to the Society and to TMAG.

Fourth: Tasmanian Aboriginal human remains are people – or rather, in the eyes of Aboriginal Community members, Ancestors. They are not specimens. The desecration of burials and removal of Ancestral remains from Country by the Society and TMAG has caused continuing trauma for the Aboriginal Community. They have had to fight for and then manage the return of their Ancestors largely without support, while mourning their desecration. An apology by the Society to Tasmanian Aborigines should recognise that the deep hurt of mistreating Ancestral remains is ongoing.

Fifth: The collection, curation and display of Tasmanian Aboriginal people and culture by the Society and TMAG created and perpetuated many of the prevailing stereotypes and myths that continue to be destructive to the Tasmanian Aboriginal Community. An apology by the Society to Tasmanian Aboriginal people should recognise that the deep hurt caused by misrepresenting Aboriginal culture and people is ongoing.

Sixth: The apology by the Society for the mistreatment of Ancestral remains (among other actions) comes thirty years after their return. Although receiving funding to resource an active repatriation program since 2001, TMAG has also never delivered a formal apology or act of restitution for its past treatment of the Tasmanian Aboriginal Community. An apology by the Society to Tasmanian Aborigines should recognise that it is belated.

PART ONE: MISTREATMENT OF TASMANIAN ABORIGINAL ANCESTRAL REMAINS

The acquisition and trade of Tasmanian Aboriginal Ancestral remains by the Royal Society of Tasmania is almost as old as the society itself, with the first recorded acquisition in 1848 by Joseph Milligan. As Royal Society Secretary from 1851–59, Milligan became the most active donor of Tasmanian Aboriginal Ancestral remains to British anatomical collections in the nineteenth century (Wise 2003, Turnbull 2017, p. 93; IS File 10891, TMAG: 'Specimens donated to Royal Society of Tasmanian Museum 1848–1886'). Through the remainder of the nineteenth century and most of the twentieth century, members of the Royal Society (and from 1885 TMAG) continued to receive donations of Ancestral remains; send them to institutions and collectors; and actively remove remains from gravesites. The last noted removal and acquisition in the TMAG Trustees' Minutes was in 1970 by Colin Wendell-Smith (3 Sept, 1 Oct and 5 Nov 1970).

William Lanne

The mutilation of William Lanne was one of the most notorious and atrocious acts of mistreatment of a Tasmanian Aboriginal person by members of the Royal Society. In 1869, Society Councillor Morton Allport successfully sought permission from Tasmania's Premier, Richard Dry, to secure the skeleton of the recently deceased William Lanne, whom it was wrongly believed was the 'last' Tasmanian Aboriginal man. Before the Society gained possession of Lanne's skeleton, hospital surgeon William Crowther and his son, Bingham Crowther, removed Lanne's skull while he lay in the Hobart hospital morgue. After discovering this, Royal Society member and hospital surgeon George Stokell, in agreement with Allport, with the Society's Secretary, James Agnew, and with Royal Society Councillor John Graves, sawed off Lanne's hands and feet and took them to their museum before he was buried (Petrow 1997, MacDonald 2005, pp. 136–182). Historian Paul Turnbull (2017, pp. 143–148) is confident that it was Royal Society members who then robbed Lanne's grave and took his body to the Royal Society's Museum storerooms where Stokell cut out the remainder of Lanne's skeleton.

Despite the public outrage and official inquiry that followed, Allport tried to find Lanne's missing skull. He offered cash to Bingham Crowther and a complete Tasmanian Aboriginal skeleton to the Royal College of Surgeons, London, as an exchange. Allport also secretly exhumed skeletons from the cemeteries at Oyster Cove and Flinders Island and in the early 1870s sent them to the Royal College and to private collector, Joseph Barnard Davis (Turnbull 2017, pp. 146–148).

Trukanini

The exhumation, display and keeping of Trukanini's remains by the Society and TMAG from 1878–1975 went against the express requests of Trukanini, the Anglican Diocese in Tasmania and the Tasmanian Aboriginal Community, as recorded in newspapers: 'Her Last Wish'; 22 Feb 1932, *Examiner*; 'Story of Truganini The Ghost of a Broken Promise', *The Age*, 20 Dec 1947; 'Dying Wish'; *Mercury*, 27 Apr 1949; 'Truganini to get dying wish', *Advocate* 12 June 1953; 'Reburial Wanted'; *Canberra Times*, 29 March 1974; 'Boffins hang onto Truganini', *Nation Review* 7–13 June 1974; 'Truganini's Bones Row, Aboriginals are angry', 1 Feb 1976; *Mercury*).

Trukanini was wrongly thought to be the 'last' 'full blood' member of the Tasmanian Aboriginal 'race', and for this reason there was intense interest in securing her body long before she died. Knowing this, Trukanini asked the Reverend Henry Atkinson to ensure she was buried at sea. But her death, on 8 May 1876, was attended by Royal Society member, Parliamentarian, and medical doctor Henry Butler who, with another medical doctor, moved her body to the Hobart hospital. The following day the Society formally requested Trukanini's body for their museum. Trukanini was instead given a Christian burial at the Cascade Female Factory, but it is likely her exhumation was always intended. The Society's second formal request to the Colonial Secretary to secure her body in July 1876 was refused because it was 'premature'; the third, in 1878, was granted (Ryan 1974; references letters 9 May and 12 July 1876 and 4 Dec 1878 in TSA. CSD 10/31/488. Copies also held in TMAG RICP RST Folder RSA/B/1 RSA/B/166). Historian Lyndall Ryan (1974) notes it is pertinent that many Tasmanian Parliamentarians were also Society members.

Ten years later, Trukanini's skeleton was placed on temporary display in the Melbourne Exhibition Building. This was contrary to the initial conditions under which her remains were entrusted by Parliament to the Royal Society: that her 'skeleton shall not be exposed to public view' (in Ryan 1974). Trukanini's skeleton returned to Melbourne in 1904, where it was articulated and casts of it made in preparation for its display in TMAG. She was exhibited in Hobart until 1947, when the son of Henry Atkinson, the Archdeacon Henry Brune Atkinson, began a public campaign to honour his father's broken promise. Consequently, TMAG placed Trukanini's remains in storage, but did not heed Atkinson's requests for a proper burial, even when they were taken up by Bishop Cranswick in 1953. The Royal Society Council agreed 'it was inadvisable that the skeleton should be lost to science' (TMAG folder, 'RICP – RST Archives', 10 Sept 1953). The Museum Trustees, and the Royal Society members, successfully sought the support of the wider scientific community to defend the keeping of Trukanini's remains. The Trustees ensured these letters were passed on to Tasmania's Chief Secretary who attended a special meeting of the Trustees. It was agreed to create a new 'Tasmanian Aboriginal Room at TMAG' with specially constructed 'memorials' to house 'skeletal remains' including those of Trukanini (Trustees' Minutes, 30 July, 3 Sept, 5 Nov, 1 Oct 1953). Nearly ten years later, Royal Society member Dr W.L. Crowther reminded the Trustees of their unfulfilled commitment to create this 'semi-mausoleum' (Trustees' Minutes, 12 April 1962).

From March 1970, the TMAG Trustees received requests to relinquish Trukanini's remains, including from Aboriginal law student, Harry Penrith. The Trustees responded that they had 'no power' to carry out this request, but they once again sought the support of the wider scientific community which uniformly agreed that 'under no circumstances should Trukanini's skeleton be destroyed'. The Trustees forwarded these letters, along with related acquisition records, to the Government. The Chief Secretary upheld the Trustees' wishes and reiterated the earlier promise of a memorial to house Ancestral remains (Trustees' Minutes, 12 April 1962). Months later, Tasmanian Aboriginal skeletal remains were found in sand dunes at Trial and Granville harbours on Tasmania's west coast. The bones were placed in TMAG's collections, and with University of Tasmania's Professor of Anatomy, Colin Wendell-Smith, further excavations were carried out (Trustees' Minutes, 3 Sept, 1 Oct and 5 Nov 1970). A letter from the University archivist Margaret Littlejohn to Mrs E.F. Cotton of Kelvedon dated 6 August 1971 confirmed that Wendell-Smith held historical collections of Tasmanian Aboriginal remains, including that of a baby (TMAG folder: 'RICP – Roy. Soc. Of Tas. Archives'). Wendell-Smith also supervised a medical student to carry out the only detailed and specific study of Trukanini's skeleton for an Honours thesis, submitted around 1973 (Meumann c.1973).

In 1974, the National Aboriginal Congress requested that Trukanini's skeleton be placed in its custody. TMAGs' Trustees were advised by a solicitor that Trukanini's remains could only be divested by an Act of Parliament. The *Tasmanian Museum Act 1950* was amended in February 1975. Trukanini's remains were then placed in the vaults of the Reserve Bank in Hobart until 8 May 1976. On that day Tasmanian Aboriginal Community members cremated Trukanini and scattered her ashes in the D'Entrecasteaux Channel.

The Crowther Collection

The Crowther Collection was one of the largest single collections of Tasmanian Aboriginal Ancestral remains formed by an individual. It was formed illegally from the early twentieth century by a leading member of the Royal Society of Tasmania. The TMAG Trustees resisted returning the collection to the Tasmanian Aboriginal Community despite repeated requests. The Tasmanian Aboriginal Centre (later Corporation (TAC)) began formally campaigning for repatriation in the 1970s and in the early 1980s took legal action against the TMAG. Although unsuccessful, this action and Community protests brought national and international attention to the Tasmanian Government (TAC 1997).

Sir William Edward Lodewyk Crowther (1887–1981) was a medical doctor; a member of the Royal Society of

Tasmania from 1911 (a Councillor from 1919–1958); a recipient of the Royal Society medal in 1940; elected a life member in 1962; and a Trustee of TMAG from 1919–1973 (von Oppeln 2007). Crowther was knighted in 1955. At his death in 1981, the TMAG Trustees stood in honour for a minute's silence (Trustees' Minutes, 3 June 1981).

Sir William was also the grandson of Dr William Crowther, who cut out William Lanne's skull in 1869, and the son of Edward Crowther, who owned land near Oyster Cove, close to the former Aboriginal Station. Sir William grew up hearing stories about 'the natives' and seeing 'several of their crania in the back surgery at [his] home' (Crowther 1949). In 1907, Crowther's University of Melbourne anatomy lecturer, Professor R.J.A Berry, urged his students to collect Aboriginal crania, especially those from Tasmania. As a result, in 1908, Crowther with Dr W. Robertson exhumed the remains of twelve Tasmanian Aborigines who were buried at the Oyster Cove cemetery in the 1840s–1860s (Turnbull 2017, p. 253). Crowther (1949) considered that the long bones were too soft to be of 'anatomical value' and packed them in two large crates (TMAG IS File 10891). The crania were in better condition. Two contained their cerebrum (brain) and were acquired by the University of Melbourne. Crowther (1949) described them as being so 'dried and shrunken ... as to resemble a small, shrivelled apple'. In 1982, the Tasmanian Solicitor-General's Department found that this exhumation had been illegal ('Draft Briefing notes for Premier for a meeting with TAC representatives, 1982, TMAG IS File 10891).

From 1919, Crowther continued to collect Tasmanian Aboriginal Ancestral remains from across Tasmania, often while he was removing Aboriginal stone artefacts with other locals including Robert W. Legge and R.H. Pulleine (Evans 2011). Most of the Ancestral remains removed were from Tasmania's northwest and from Eaglehawk Neck. They included both prehistoric and more recent burials, including an infant. Many of the skulls 'in better preservation' were acquired by institutions and collectors. By 1961, Crowther had housed his collection of three skeletons and thirty-four skulls in TMAG, and he formally presented them in 1963. Crowther (1949) studied and published on the collection and facilitated and urged such study by others.

From 1981, members of the Tasmanian Aboriginal Community sought the return of the Crowther Collection. The TMAG Trustees offered to 'share' the responsibility of the collection with the Aboriginal Community but would not hand the remains over to them. They sought advice to defend this position legally and, with TMAG's staff anthropologist sought and received letters of support from leading scientists and scientific associations (correspondence 1982–1984, TMAG IS File 10892).

Other collections of Tasmanian Aboriginal Ancestral remains

By the early 1980s TMAG was aware that it held about 100 Tasmanian Aboriginal crania or fragments of crania, three of which were from named individuals: Augustus, Caroline and Waubedabar (Waubedema or Waubedimia). This number included the Crowther Collection, but mostly comprised of other acquisitions. Numerous acquisitions had been made to the Royal Society of Tasmania from 1848 to 1886, and to TMAG from 1886 to the late 1970s. Members of the Society actively collected Ancestral remains and published their findings in their Papers and Proceedings until the late 1970s. The TMAG Trustees also instigated the removal of Ancestral remains and accepted donations from the late nineteenth century to the 1970s. The following examples demonstrate TMAG's active effort to obtain Ancestral remains from the late nineteenth to late twentieth centuries:

> *The Bishop of Tasmania had on a visit to [Vansittart?] Island, formerly Gun Carriage Island, came across graves of seventeen Tasmanian Aborigines. The TMAG Curator was authorised to make necessary arrangements to secure 'the skulls and skeletons'.* (Trustees' Minutes, 19 Sept 1899)

> *TMAG Director reported that 'he was hopeful of obtaining another Tas. Aboriginal skull for the Museum collection' and it was 'resolved that the Director be empowered to incur reasonable expenditure in order to secure same'.* (Trustees' Minutes 30 Oct 1924)

See the example of Wendell-Smith's removal of Ancestral remains in 1970 mentioned previously.

In a landmark paper presented on behalf of the Tasmanian Aboriginal Community to the Australian Archaeology Association conference held in Hobart in 1983, Rosalind Langford (1983) claimed that TMAG and its staff had deceived the Aboriginal Community in 1976 by 'concealing the fact that they held the remains of Aborigines other than those of Truganinni [Trukanini]'. From 1982, the Tasmanian Aboriginal Community formally sought the return of 'all' the Tasmanian Ancestral remains held in TMAG. The TMAG Trustees remained determined that they should retain their collections, except for one Trustee. The Minutes of the Trustees' meeting held on 6 October 1982 record that one Trustee moved 'that all Tasmanian Aboriginal skeletal remains in TMAG be handed over to the Tasmanian Aboriginal people for appropriate disposal'. The motion 'lapsed for want of a seconder'. The Minutes of the Trustees of 2 February 1983 stated: 'It has been made abundantly clear on earlier occasions by the Trustees that they did not favour the removal [return] of the skeletal material.' The Tasmanian Aboriginal Community took legal action and carried out public protest and demonstration. In 1984, the TMAG (Aboriginal Remains) Act authorised the return of Tasmanian Aboriginal Ancestral remains to the Community. On 13 August 1984, TMAG staff wrote to the Trustees 'strongly protesting' the government's decision and continued to seek the support of the wider scientific community (Trustees' Minutes 5 Sept 1984). In 1985, the Crowther Collection and the remains of the three named Aboriginal people were returned to the

Tasmanian Aboriginal Community. The remainder of the collections known to be Tasmanian Aboriginal Ancestral remains were returned in 1988.

Over many years several external researchers were encouraged and given access to the Ancestral remains collection (Berry & Robertson 1909, Crowther & Lord 1920, Crowther 1921, Abbie 1964). Researchers applied their own theories to the cataloguing and the physical storage of the Ancestral remains. The results of this intervention included separating the skeletal remains of a person and wrongly boxing remains belonging to different individuals together. Such poor curatorial practices have made recent provenance research to aid repatriation efforts nearly impossible. Due to this poor record keeping and questionable research practices as well as substandard storage and mismanaged repatriation processes of the past, in 2018, TMAG continues to hold a collection of poorly provenanced and unprovenanced Ancestral remains. Some of these remains include Ancestors from Indigenous Communities outside Tasmania. As Franchesca Cubillo (2010, pp. 30–36) notes, keeping other peoples' Ancestors trapped in collections weighs heavily on traditional owners working in those institutions. Currently the repatriation of other Indigenous peoples' Ancestral remains outside of Australia is unfunded and not covered by the Australian Government's Indigenous Repatriation Policy.

Return of Ancestral remains

Aboriginal people have lived on lutruwita, the Country now known as Tasmania, for more than 40 000 years. Aboriginal spiritual beliefs are that they 'have been here forever' and the connection to Country, Ancestors and kin are inalienable. As such, it is imperative that Ancestors are acknowledged, respected, and given the appropriate ceremony in death. Many Aboriginal people feel a profound responsibility to return Ancestors to Country. This is critical for honouring the Ancestors' dignity and to allow their spirit to finally rest, as well as allowing the Aboriginal Community today to mourn and heal.

The Tasmanian Aboriginal Community have had to fight for recognition and for the return of their Ancestors through political and legal battles. As Cubillo (2010, p. 25) writes: 'Indigenous communities were not responsible for the problems associated with repatriation, and yet they have to carry the cultural, spiritual and financial burdens.' The struggle to return known people and the knowledge that many more 'unprovenanced' remains may never return causes ongoing distress to Aboriginal people who are responsible for their Ancestors' safe return home. The disrespect with which Ancestral remains have been collected, traded, stored and researched often means that little is known about the Ancestors who are returned to Community. This lack of knowledge adds further stress and complexity to the decisions regarding proper ceremony, burial practice and reburial place. The wounds caused by the desecration of burials, and the collection of Ancestral remains, are not historical; they are ongoing.

Collectors placed a high value on the remains of Tasmanian Aboriginal people in particular. The Society and TMAG played a major role in the 'scientific trade' of Tasmanian Aboriginal Ancestral remains and received the Ancestral remains of other Indigenous peoples in exchange for Tasmanian Aboriginal remains as well as collegial recognition. Ros Langford outlined this issue poignantly in 1983 (p. 2):

> *Science, including the science of archaeology, determined that Truganinni was the last of our people. It did so by using scientific principles based upon European values. The effect of this 'scientific fact' has been incalculable to the 4000 Tasmanian Aboriginals who reside in Tasmania … Science got what it wanted – some bones to parade through Europe enhancing the reputation of white colonials, leaving us with the struggle lasting 100 years to defeat that view. And science did not assist us in that fight. But what has changed? It was the Aboriginal people who fought for the return of the grave-robbed skeletons known as the Crowther Collection. There was no agitation from within your discipline for their proper burial or cremation. Instead, there was opposition and obstruction to our demand for the return of the dead…*

The return of Ancestral remains from TMAG to the Tasmanian Aboriginal Community in the 1980s was inadequately managed. The research into the history of the collections in the 1980s was carried out in large part by TMAG's staff anthropologist who objected to their return (as noted above). More extensive and comprehensive research into the related records was not undertaken until 2002 when TMAG began receiving funding under the Australian Government's 'Return of Indigenous Cultural Property' project (in 2018 the Indigenous Repatriation Program, IRP). In the 1980s, there were neither sufficient related records and information given to the Aboriginal Community, nor adequate support given for the management of returned Ancestral remains, or for the ongoing trauma caused by their removal and return. An important instance of this mismanagement was the return of Waubedabar (Waubedema or Waubedimia) who was returned in 1985 and her remains cremated, only for it to be discovered in 2005 that half of her skeleton was still held in TMAG's zoological collections. Waubedabar's handing back, and cremation had to be done again in 2007, and the trauma and grief was experienced by the Community once more.

PART TWO: MISTREATMENT AND MISREPRESENTATION OF TASMANIAN ABORIGINAL CULTURE AND PEOPLE

Removal of petroglyphs

In 1961, TMAG instigated the removal of rock engravings from Preminghana, or Mt Cameron West, on Tasmania's northwest coast. Tasmanian Aboriginal Community members and archaeologists regard this 'removal' as having been destructive to some of the most important petroglyphs (huge rock engravings) in the world and of a site of deep cultural significance (TAC 2015, Tiagarra 2018).

Then-Tasmanian Museum Director, Dr William Bryden, stated that TMAG should remove the Aboriginal stone carvings because they were 'being destroyed by erosion'. Permission to access the area was granted by the Van Diemen's Land Company manager, and a tractor, trailer and labourers were hired and paid for by TMAG. The Director and Mr R. Roth excavated Aboriginal middens in the region during the removal (Meston 1931, Trustees' Minutes 2 Feb and 5 Oct 1961).

The removal broke the carvings; one larger petroglyph was pieced together and mounted using concrete in the Tasmanian Museum and was on display by mid-1962 until 2005 (Trustees' Minutes 7 June 1962). Archaeologist Rhys Jones told fellow archaeologist and interviewer Mike Smith that when Australia's leading archaeologist, John Mulvaney, visited Tasmania's northwest coast in the 1960s, he was '*absolutely* shocked' by what he saw: 'they had sawn off the face of the carvings' and there 'were bits of carvings lying all around, all broken'. Moreover, Mulvaney understood that the reason TMAG had removed the petroglyphs was 'because Launceston [QVMAG] already had one... and there was a great rivalry' (Jones & Smith 1997).

Removal of Tasmanian Aboriginal stone artefacts

From the mid-nineteenth to the mid-twentieth centuries, collectors have removed tens of thousands of Tasmanian Aboriginal stone tools from sites across the island, including middens, quarries, and campsites. This has left a deficit of important cultural material and erased part of the record of earlier land use, occupation, and cultural practice for today's Tasmanian Aboriginal people.

Some of these prodigious collectors were members of the Royal Society, including Sir William Crowther, Fritz Noetling and Robert Legge. These men formed large personal collections of stone tools from across Tasmania from the early twentieth century and deposited them in museums locally and overseas. Stone tools make up the largest part of the overseas Tasmanian Aboriginal collections. These collectors influenced leading scholars in Europe and beyond through their correspondence and publications in which they advanced the idea that Tasmanian Aborigines represented the earliest, or most primitive stage of human cultural evolution: the Old Stone Age or Palaeolithic (Noetling 1907, Crowther 1949, Taylor 2017, p. 24, p. 64).

The correspondence of Henry Ling Roth and James Backhouse Walker

Henry Ling Roth's *The Aborigines of Tasmania* (1890) was the first anthropological account of the subject, and its second edition (1899) remained the most influential book on Tasmanian Aborigines until the late twentieth century. This book advanced and perpetuated the idea that Tasmanian Aborigines were 'extinct' and one of the most primitive 'races' on Earth.

Roth was inspired to rework his first edition after reading a claim in *Nature* magazine that Fanny Smith (or Fanny 'Cochrane' Smith) was a 'full blood' Aboriginal, not a 'half caste' as he had been led to believe (Roth 1889). Roth wrote to the Society to determine the veracity of his claim. Over the next ten years, a Royal Society Councillor James Backhouse Walker carried out research into Fanny Smith on Roth's behalf to determine this and other questions. Taylor (2016, 2017, pp. 91–105) gives an account of this correspondence and details its holdings in the University of Tasmania and the Manchester Museum. Walker was assisted by Hobart photographer J.W. Beattie, who was elected as a Fellow of the Society in 1890 and who helped establish the historical and geographical section of the Society in 1899 (Roe 1979).

The research and the conclusions drawn by Walker (and consequently by Roth) influenced how people understood Tasmanian Aboriginal people and their culture for most of the twentieth century. It was deeply insensitive and disrespectful to Fanny Smith, her family and to the wider Tasmanian Aboriginal Community. The research carried out for Roth, undertaken or organised by Walker included photographing Fanny Smith at her home in order to determine her 'racial status'; obtaining a sample of her hair; removing family photographs from the Smith family (and not returning them); and asking her friends about her 'mental' and 'physical details' including her ancestry and the shape of her teeth.

Walker, with other members of the Society recorded Fanny Smith singing in language in 1898, but they agreed that she did not have any other Aboriginal cultural information that was 'valuable' because she was, in their opinion, 'manifestly a half-caste' (Taylor 2017, p. 95).

Other research carried out by Walker for Roth included:

- attempting repeatedly to obtain six Tasmanian Aboriginal skulls kept by Edward Cotton of Kelvedon (Bishop Montgomery also tried);
- organising the study of nineteen Aboriginal skulls housed in TMAG in Hobart;
- trying to extract a piece of hair for study from an ochred lock that once belonged to Wurati (Worreddy) or Manalakina (Mannalargenna);
- sending Roth a piece of hair belonging to Trukanini;
- sending Roth a shell necklace, but then claiming it was not 'genuine' as it was made by a 'half-caste' Islander (whom Walker stated 'are *not* Aborigines');

- compiling language lists, memories and other accounts from settlers that Walker regarded having more authority than the 'half-caste' Islanders, or Fanny Smith and her family.

CONCLUDING REMARKS: MISREPRESENTATIONS OF TASMANIAN ABORIGINAL PEOPLE AND CULTURE

As institutions of knowledge, expertise and authority, the Royal Society of Tasmania with the Tasmanian Museum and Art Gallery helped construct and perpetuate myths through an ongoing process of colonisation. For many years, the Society (and from 1885 TMAG) have labelled, measured, categorised, and degraded Tasmanian Aboriginal people to suit European ideologies and racial theories. For 140 years, the collection and curation of Tasmanian Aboriginal people and culture by TMAG was heavily informed by the ideas of 'primitivism' and 'extinction', that were used, as Langford (1983) puts it: to 'soften the guilt of invasion and the destruction of a society' (Burk 2015).

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VAN DIEMEN'S LAND AND THE GREAT EXHIBITION OF 1851

by Michael Roe

(with six plates)

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Imperial authorities questioned whether so distant Van Diemen's Land could participate in the 'Great Exhibition' to be held at London's Crystal Palace in 1851, but as it transpired, the locals made a notable showing. Aspiring to display the positives of 'his' colony, Lieutenant-Governor Sir William Denison was the driving force behind this participation, with Joseph Milligan his chief aide and members of the local Royal Society notably assisting. The range and types of exhibits were remarkable and fascinating. Contributions came from various local quarters, one of interest being an ex-convict with whom Denison had some political liaison, whereas, conversely, Denison's critics tended to abstain from involvement. Women played a role in contributing exhibition pieces, as did Aboriginal Tasmanians – Milligan no doubt crucial in orchestrating this. Denison was especially concerned to display Tasmanian timber, and other primary produce, but the thrust of the Exhibition was to celebrate human skills, and the contributions of manufactured goods and superior hand-crafted items conformed to that pattern. The world saw exhibits bespeaking an active, achieving society, and although the Vandiemonian contribution won modest notice in the British press, locals gained a share of the many awards granted to exhibitors. Not that the whole story was triumphant – some jealousies resulted and its difficulties and tensions also told of time and place.

Key Words: Van Diemen's Land, Great Exhibition 1851, Sir William Denison, Vandiemonian, Tasmaniana.

INTRODUCTION

On 12 April 1850 Britain's Secretary of State for the Colonies, Earl Grey, signed a despatch to Lieutenant-Governor Sir William Denison that enclosed a prospectus of the Great Exhibition to be held in London a year hence, under the active patronage of Queen Victoria and the Prince Consort and supervised by distinguished Commissioners (TA GO 1/1/77, Inward Dispatch, 12 April 1850). Grey told Denison his hope was that Britain's colonies would have their part in this undertaking but remarked that the vast distance between Van Diemen's Land and the London metropolis might force an exception in this instance. The cited deadline for submissions was 1 March 1851. Instead, Denison, ever a man of determined and self-righteous action, seized the chance to tell the world of his domain's resource, and, as it transpired, he largely succeeded in conquering the tyranny of distance.

As an engineer by training, and of a family active in Britain's industrial boom, Denison fitted the Exhibition task. Among his pertinent activities since taking office in 1847 was to energise the Royal Society of Van Diemen's Land, achieving its fusion with the older 'Tasmanian Society', and appointing Joseph Milligan as salaried Secretary (conjoint with his Superintendence of the Aboriginal station at Oyster Cover). Milligan and the Society were to be the Governor's instruments in the Exhibition project. Denison had anticipated Grey's approach, prompting Royal Society discussion on 4 and 18 July 1850 of a possible Tasmanian display at the Exhibition (RST Council Meeting Minutes 4 & 18 July 1850, RSA/A2). Grey's despatch arrived in early August, and on the 15th Denison reported its content at a further Society meeting. 'His Excellency mentioned oils of the Black and Sperm Whales, or the finest samples of wheat – of wool, of furs, of timber useful and ornamental; of our coals and also of such manufactures as we possess.' (ibid.). There was now appointed a 'general' committee to oversee the task, but immediate action lay with a sub-committee comprising Denison, Milligan, Robert Officer, W.S. Sharland and Hugh Hull. Within days it met and prepared a statement as to the materials that might be offered.

The statement was endorsed by the 'general' committee on the 24th, which now further determined to ask approval from the Legislative Council for expenditure up to £250, and to ask Charles McLachlan, an important figure in local business and politics at the time, to be its London agent. Both moves won acquiescence. Invitations then went to some fifty individuals inviting them to join further committees that would vet submissions, and such committees were duly formed (*Hobart Town Gazette* 3 September 1850, p. 702).

Another initiative was to establish an action group in Launceston, with Joseph Milligan's brother Alexander appointed the leader. An interesting member was R.C. Gunn, erstwhile authority of the Tasmanian Society and important in its merger with the Royal Society of Van Diemen's Land. Gunn now managed properties of the late Robert Lawrence, whose daughter and widow had both married into the Milligan family. Also serving on the northern committee were Presbyterian leader R.K. Ewing, Anglican counterpart R.R. Davies, naturalist-surgeon James Grant, and Charles and Andrew Henty. All were Royal Society members (*Launceston Examiner* 2 July 1850, p. 4).

A despatch from Denison to Grey dated 26 August acknowledged the latter's April communiqué and told of pertinent events, back to July (TA CO 280/62). It affirmed that the colony would meet its quota of available space (1200 super feet, half for corridors and half for items), but accepted possible difficulty in meeting the 1 March deadline. Could Grey seek lenience for this distant place?

The *Hobart Town Gazette* of 3 September published this 'statement' from the Society, calling for submissions, stressing how brief was the time in which to act, and setting a context:

> *The committee desire to impress upon the Landowners, Merchants, Tradesmen, and Inhabitants generally of this Island, that it is of last importance than no inferior or second-rate sample of our staple products, such as wheat and wool, should be exhibited where they will stand in juxtaposition and have to bear comparison with the finest commodities of a similar description from the most favoured regions of the world; and that it is quite as essential, in order to secure a just appreciation of the importance and value of our ornamental timbers and other raw material the produce of the Island, that the best craftsmanship which the Colony is possessed of should be bestowed upon them,—bearing in mind that here also comparison must be sustained with the finest materials, and the highest efforts of the best workmen of the world at the present time.*
>
> *Confident that Tasmanian wheat, wool, and timbers, whether for ship-building or ornamental purposes, need not shrink in comparison for a prize in the eyes of the civilised world, and solicitous that no advantage which the Colony possesses should from apathy or inadvertence be thrown away, the Committee repeats that they are most anxious to have it in their power to forward for exposition the finest samples which the Island affords; and they earnestly, therefore, entreat persons possessed of first-rate qualities to forward samples without delay.*
>
> *Great Britain, confident in the vast and varied resources of an empire on which the sun never sets, and in the possession of machinery, engineering skill and artisanship all but omnipotent, has challenged the world to competition. Let us not think that we bring a feeble and inefficient contingent to the aid of our mighty Fatherland. We have corn, wool, and oil, for man's necessities and his comfort – we have coal and iron to give him power and command – we have timber (not to be surpassed in the world) for ship-building and for ornamental purposes; at once elements of national strength, and a guarantee for advancement in commerce, civilisation, and refinement.*
>
> (*Hobart Town Gazette* 3 September 1850, p. 701)

These Churchillian words probably came from Denison's hand, with the committees assisting. Denison authorised that the government printer issue 500 copies of this statement for general distribution (TA CSO 24/1/173/5010).

Joseph Milligan and the committees now set to garnering exhibits. Presumably government officers joined the task but there is little information as to how the process proceeded. What inducements were held out to prospective exhibitors? How stringent were the committees in vetting items? While no answers can be given, a little more is known of the northern committee than the southern ones, as it reported to the Royal Society in Hobart in mid-September of 'doing all in their power [but] they were not sanguine that they will be able to affect a great deal' (RST Council Meeting Minutes 18 September 1850, RSA/A2). Yet this committee did advertise in the press, as it seems no southern group did. One important decision of the committee-in-chief was to send exhibits by the *Derwent*, at £5 per ton (excepting £3 for 'long timber').

Papers received from the Colonial Office in mid-November might have added to the committees' burden. The London elite spelled out exhibitors' responsibility for packaging their wares and post-Exhibition disposal. As against this, Customs duties would not be exacted. Bronze medal prizes would be awarded, with honourable mentions following. Multiple juries would determine award winners, and all this was outlined in the *Hobart Town Gazette* (26 November 1850, pp. 1023–1026).

Local politics

Local politics had some bearing on future developments. In the background lay the passage in Britain (August 1850) of the *Australian Colonies Government Act*; this was to come into force a year hence and thereby the local Legislative Council would expand, with a majority of elected members (Townsley 1977). Vandiemonian support for such reform came largely from elites, anxious to secure further power over their domain; backing came also from the press, especially the *Hobart Town Courier*. Overall, these forces sought the end of convict transportation to Tasmania, so Denison and Earl Grey, who strongly supported transportation, became the targets of their attack. The Grey–Denison sponsorship of the Exhibition perhaps tainted it among these opponents of the Governor and deterred them from participating. While that claim must be hesitant, there can be no doubt that Denison saw the Exhibition as offering scope to display what his governance had achieved.

The story has a further side. While one must hesitate in proposing that colonial elites resiled from supporting the Exhibition, a corollary has more force: the roll of local exhibiters clinches that the project won favour from a 'rising middle class' such as has been the dynamic of change in many a society. In turn, Van Diemen's Land's history ensured that ex-convicts were prominent among mobile types. This makes all the more interesting (whether as cause, effect, or mere coincidence) a current surge of politics from that quarter: early in October 1850 was founded the 'Tasmanian Union', strong in support of Denison and still stronger in antipathy to anti-transportationists, seen as determined to impose monstrous stigma on all ex-convicts (Roe 2016). Feeling was mutual: 'they return, like dogs to their vomit, and seek to play off Sir William Denison as the friend of the prisoner,' said *The Courier* of Union leadership (*The Courier* 9 November 1850, p. 2).

Meanwhile, Milligan and the committees persevered. Proposed exhibits were gathered in Hobart and some final vetting then applied. The *Advertiser*, alone among established journals in supporting Denison, noticed in mid-November that items were now on display and for three days before exhibits went aboard the *Derwent*, they stood in the ballroom of Government House. Everyone – but especially 'operatives' – were invited to see them; responders approached 2000 (*The Britannia And Trades' Advocate* 21 November 1850, p. 2; The *Cornwall Chronicle* 28 November 1850, p. 847).

A Denison despatch joined the cargo, repeating earlier doubts as to meeting the 1 March deadline, and again seeking Grey's support for lenience 'in favour of a Colony at so great a distance, the Inhabitants of which have exerted themselves so strenuously' (Denison & Denison 2004, p. 139, p. 148). Denison remarked that the exhibits included several from government institutions, convict stations and the Orphan School, and asked that should any money arise from post-Exhibition sale of the school's offerings, that it goes to the children. The colony's splendid timbers, continued Denison, well might come before Admiralty's notice. Also, aboard *Derwent* was an overview of the exhibits and their proposed arrangement, provided by Milligan as the author. Meanwhile, Lady Denison told her mother that 'we really muster a very respectable assortment' of items, and likewise invoked the Exhibition as she wrote to a British friend in March 1851, encouraging the recipient to pressure her influential husband to boost Tasmanian timber.

Derwent sailed in mid-December 1850 and arrived in London on 31 March 1851, stretching the deadline by a mere 30 days. McLachlan helped in getting exhibits to display, but evidently more active was Edward Barnard, the 'Colonial Agent' – a shadowy but important office. Onerous enough, the couple's task was minuscule compared to the overall preparations needed for the Exhibition's debut in Hyde Park's Crystal Palace on 1 May. The official *Catalogue* (Catalogue 1851) became ready just a day before and its big volumes pulsed with descriptive detail, further supported by a decorative poster advertised in the *Illustrated London News* on 24 May (pl. 1). Robert Ellis (British Museum Librarian and editor-in-chief) noted apropos Tasmania '...some interesting and attractive articles of furniture, ... a few specimens of textile manufacture, ... a remarkable number of specimens of fur, ... woods applicable for every purpose of art or use' (Routledge 1851, p. 992). 'Huron' [sic] pine received special praise, that solecism often repeated; 'Tasmania' and 'Van Diemen's Land' were used randomly (as in this paper).

While Van Diemen's Land's independence was perhaps overly stated as a country among Britain's possessions in Australasia, its extensive contribution of objects was correctly noted (pl. 2). A full list of local exhibits is contained in the *Catalogue*, with many columns detailing their use or collection, drawing from Milligan's personal account (Catalogue 1851, Vol. 2, pp. 992–1000). They must be read with care as obviously Milligan presented the items in the best possible light. Some exhibitors remain mysterious; such entries as those for Denison, the Milligans, McLachlan and more modest others indicate the channel of collection rather than the creator of the item. The *Catalogue* included at least one entry – having Denison's particular esteem – that never made the Exhibition. This was a mighty Blue Gum *Eucalyptus globulus* plank cut at Long Bay in the D'Entrecasteaux Channel and hailing from the Huon yard of eminent shipwright John Watson (pl. 3). Its size proved overwhelming. The enormous plank at its original size (length 146 ft, breadth 20 in., depth 6 in.) was too much for the *Derwent* and had to be transported by another vessel (*The Courier* 15 January 1851, p. 2; Outward despatch, 23 January 1851, TA CO 280/73. The *Australasia* which left Hobart in late January 1851 carried a document revising the entry lists originally sent by the *Derwent*; this account presumably told of the plank's trouble, but it arrived too late to be corrected in the *Catalogue*. The plank was last reported at Manchester, on the way hailed by the London *Times* as 'supposed to be the longest ... in the world' (*The Courier* 17 November 1852, p. 2). Presumably, items damaged in transit which included some honey, hops and wheat/flour, also made the *Catalogue* but not the 'Palace'.

CATALOGUE OF EXHIBITORS AND EXHIBITS

Withal, the *Catalogue* offers an insight into the fascinating and rich diversity of Tasmaniana (https://catalog.hathitrust.org/Record/001511518, 177–182), presented here under exhibitors' names with its associated detail:

"ABBOTT, John: 'iron-sand, a fine emery-like substance which occurs in thin layers on the sea-shores of Long Bay in D'Entrecasteaux Channel'.

ADCOCK, Mrs. Mary, Hobart: two canisters of preserved meat.

AKERS, C.S. (Royal Engineers) Lieutenant C.S.: N[orfolk] I[sland] pine.

ANDERSON (? possibly ARMSTRONG), Hobart: set of ladies' tortoiseshell combs.

BARNARD, James, Hobart: swansdown skins.

BICHENO, J.E.: alum, found near Bridgewater; limestone from the Western Marshes 'at a place noted for extensive caverns,' and from Mount Wellington foothills.

BLACKBURN, J., and THOMSON, J.: model of Bridgewater bridge, 'constructed of Huon pine ... on the scale of an inch to a foot ... erected by the exhibitors from their own design ... constructed by W. Armstrong, under the direction of W.P. Kay ... the length of the bridge is 960 f[ee]t., the breadth of the roadway is 24 ft., and it is raised upon piles, the number of which is 363; the piles measure from 65 to 90 ft. each in length, and are driven through mud and soft clay ... The whole length of the bridge and causeway is 3,3312 ft. The work was begun in 1833 by Colonel, now the Right Hon Sir George Arthur, and completed in 1849 under the Government of his Excellency Sir W.T. Denison, at an entire cost of upwards of £50,000. The navigation

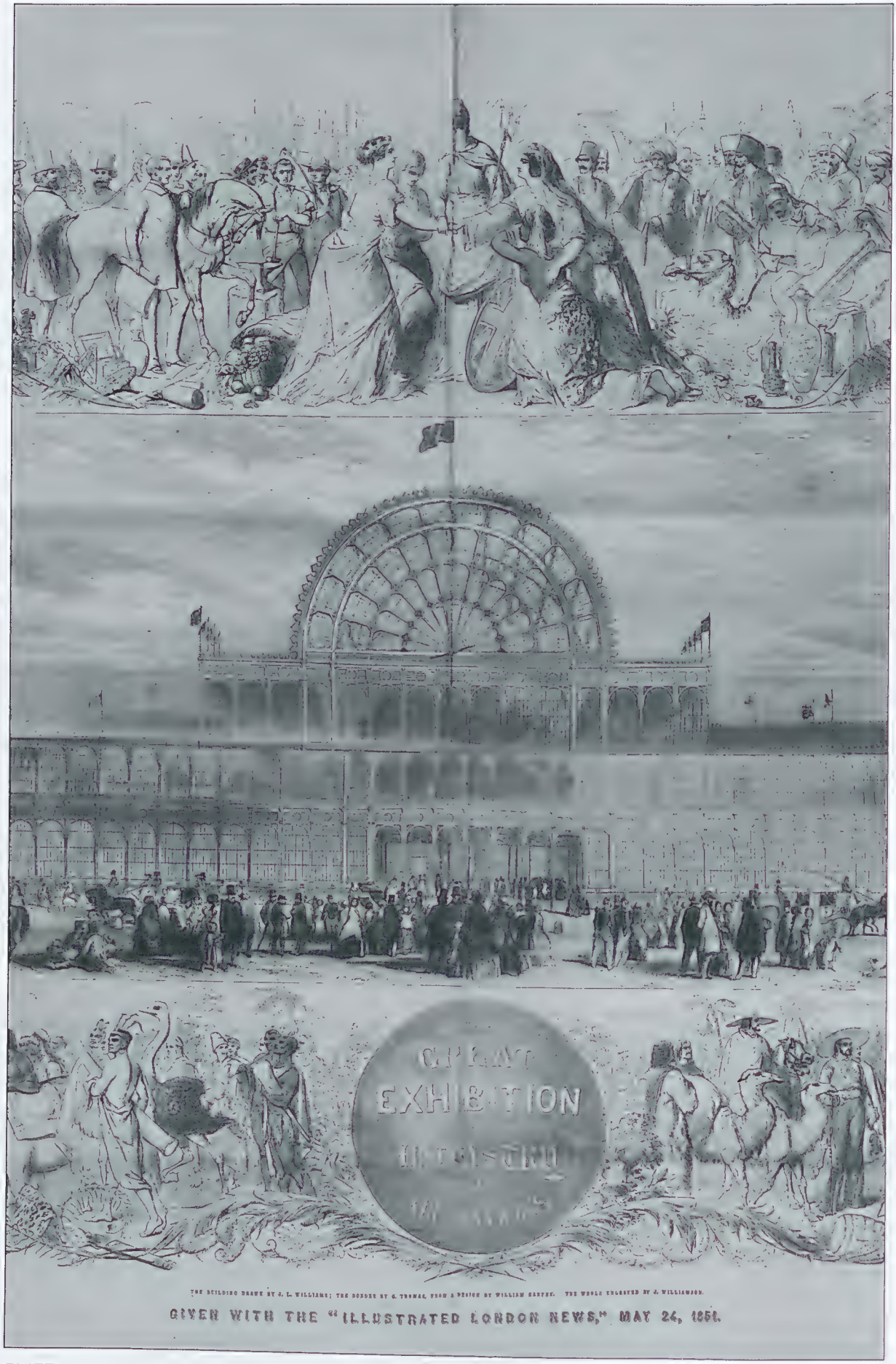

PLATE 1 — The beautifully illustrated London Great Exhibition poster, which appeared in the *Illustrated London News* in May 1851. (Special & Rare Collections, Morris Miller Library, UTAS)

V.

BRITISH POSSESSIONS IN AUSTRALASIA.

EASTERN ARCHIPELAGO.—AUSTRALIA.
VAN DIEMEN'S LAND.—NEW ZEALAND.

THE countries represented under this head, and above enumerated, have sent interesting collections of native produce of different kinds. Of these, the collection from Van Diemen's Land is the most extensive, comprising objects sent by a considerable number of exhibitors. In each instance, however, the attempt had been made to send for exhibition such articles as represented best the peculiar products of the country exhibiting. Many of the objects are of great importance to the merchant seeking a new source for known materials.—R. E.

PLATE 2 — Repute of Van Diemen's Land in the British Colonies (Catalogue 1851, Vol 2, p. 988).

WATSON, JOHN, *Hobart Town.*

346 Plank of blue gum (*Eucalyptus globulus*); length, 146 ft., breadth, 20 in., depth, 6 in.

[The various species of *Eucalyptus* attain generally a great size both in girth and length in sheltered situations, where the forest is thick, where there is no grass, and where injury has never or very rarely been sustained from bush-fires. Blue gum has been measured upwards of 90 feet round near Tolosa, on the northern aspect of Mount Wellington range, and on the southern side, according to the Rev. T. J. Ewing, one of the species has been measured 102 ft. at 3 or 4 ft. from the ground. Another *Eucalyptus*, called stringy bark, exists near the Cam River, on the north coast, measuring 64 ft. of solid timber at 4 ft. from the ground; the tree, having somewhat the form of a four-sided column with its angles bevelled, is 200 ft. to the first limb, where it is estimated to be more than 4 ft. in diameter, giving the enormous cubic measurement in the trunk alone of more than 1,000 tons of timber.]

PLATE 3 — Information about the 'big plank' as recorded in the exhibition catalogue. The plank was not subsequently displayed at the exhibition due to difficulties in transport (Catalogue 1851, Vol 2, p. 999).

of the river has been secured by the construction of a moveable platform, or rolling bridge … The longitudinal beams upon which rests the platform or roadway of the moveable or rolling portion of the bridge, are shod with iron, and travel upon large flanged wheels, fixed upon a pier intended for the purpose, and the mode of moving this rolling part is by powerful crab-winches, working on toothed rails fixed on the framing of the bridge, worked by men standing on the moving part and moving with it. The lateral platforms are also moved in and out by crab winches fixed on the framing below.' [Thomson also exhibited a 'coloured, sectional elevation' of the mighty work.]

BONNEY, Joseph, Perth; Tasmanian birds, in case; manna, 'an exudation from the white gum-tree … its properties are similar too, but less powerful than those of the manna of the druggist'.

BOYD, James: Marble from Maria Island cut and dressed as paperweights.

BROCK, Henry, Hobart: 'common seamen's biscuits'; ship biscuits.

BROWN, John, Launceston; blackwood sideboard; top of star loo table in Huon pine and blackwood; lady's table of muskwood.

BROWN, Fielding, Hobart: candlestick in NI ironwood, the tops from root of NI pine.

BROWN & COMPANY, Hobart: white wheat, casks in Huon pine and blackwood, with wattle hoops; oil of black whale, sperm whale, and black fish.

BROWNRIGG, Francis, Reverend: muskwood.

BURGESS, Mrs. Emma, Hobart: 'worsted work, representing a branch from a blue gum tree in flower, with four birds of Tasmania perched on the twigs. The birds are a redbreast, a small honey-sucker, a pardalote, and the blue-headed wren. The frames of this and the next are of the timber of the myrtle-tree of Van Diemen's Land, made by Mr. Pearson [Pierson], of Hobart Town;' 'worsted work, representing a group of indigenous flowers of Tasmania. In the centre is a waratah; immediately over it is a head of the grass-tree of Mount Wellington, in flower, then in order come *Acacia vercillata, Billiardiera longiflora, Acacaia armata* (an exotic), *Richea sp., Acacia mollissima, Acacia verniciflua, Casuarina quadrivalvis, Pomaderris, Boronia variabilis, Tetratheca sp., Solanum laciniatum*'.

BUTTON, Thomas, Launceston: dressed kangaroo skin; parchment.

BUTTON, William, Launceston: samples of glue; solution of mimosa bark (noted for its tanning efficacy); dressed kangaroo skin.

CHAMPION, William, Hobart: 'round turnover table [of muskwood] with brass work and springs of Tasmanian manufacture.' [See also Hamilton and Moses, below.]

CLAYTON, Henry, Norfolk Plains: flour, cask in wattle.

CLEBURNE, Richard., Hobart: soap.

COX, Francis: Tasmanian insects, in case.

DAVIES, Archdeacon R:R.: rug of black opossum skins; ditto, brush-kangaroo.

DEANE, DRAY, & DEANE: wheat. [This was a London firm specialising in agricultural machinery, seemingly agents for McPherson & Francis (see below).]

DENISON: Blue gum log; stringy bark; blackwood; sassafras; myrtle; tobacco leaf (NI]); arrow-root (NI); maize (NI); cayenne pepper (NI); wheats – Farmer's friend, white velvet; James's Essex; golden drop, white Kent, mother of plenty, velvet, white Lammas (all NI); Chidham wheat; muskwood; myrtle; cedar or pencil pine; celery-topped pine; dripstone (NI); rosewood; roll of tweed ('manufactured by the inhabitants of Cascades' establishment'); loo-top table, dogwood; 'pedestals for the same'; sofa-table top, chess board inlaid; rug of various furs – brush kangaroo/wallaby; forest kangaroo; black opossum; native cat (eastern quoll); tiger-cat (spotted-tail quoll); six tanned platypus skins; section of honey suckle tree; ditto, she-oak; NI maple; blue gum sections; limestone (Maria Island); calcareous grit (NI); blood juice, derived from a tree (NI); walking stick made from whale bone; coffee (NI); potash from blackwood, wattle, oak, peppermint; blue gum; red ochre from jasperous iron ore; yellow ochre; marl; white oak; pine; iron-wood (NI).

DE LITTLE, Robert, Launceston: galena from the Tamar; iron ore from York River.

DIXON, James, Isis: flax ('this exhibitor … is endeavouring to establish the cultivation of the flax in Tasmania'); box of dried apples ('generally, more fruits are dried in the northern than the southern side of Van Diemen's Land').

DOUGLAS RIVER COAL COMPANY: two bushels of coal.

DOWLING, Henry: *Tasmanian Calendar* [*Wood's … Kalendar*], 1848, '49, and '50.

DUNN, Hobart: *Mylitta Australis*, native bread from the Snug Estate, North West Bay. 'The native bread of Tasmania, which grows underground, like the truffle of England, and, like it, has a peculiar smell. It is edible. Having formed in a half-roasted state, portion of the diet of aborigines, and has been successfully tried in soup and in puddings. This specimen is unusually large, having weighed 14½ lbs in 1846, at present it weighs 10½ lbs'.

FENTON, Mrs. Elizabeth: honey.

FLEGG, Charles, Hobart: Wellington boots of kangaroo skin.

FOWLER, W., Maria Island: dogwood; muskwood; [s]he-oak; ironwood.

FRASER, Andrew, Hobart: pair of carriage wheels, made of blackwood and blue gum.

FREEMAN, Edward, Reverend, Brown's River: veneers of Tasmanian oak, [s]he-oak, cherry tree, and honeysuckle tree; myrtle tree knot.

GRANT, James, Fingal (of Tullochgorum): three ram fleeces, weighing up to 4 lbs.

GUNN, William, Launceston: mutton-bird feathers ('much used for pillows, bolsters, and mattresses'); with Alexander MILLIGAN: mutton-bird oil ('said to possess value as a liniment in rheumatism, and it burns with a clear bright light. The sooty petrel frequents certain low sandy islands in Bass's Straits in vast numbers during the

summer, burrowing to lay its solitary egg, and literally undermining the ground.')

HADDON, Captain W.C., Royal Engineers: muskwood.

HAMILTON, William, Hobart: 'hall chair of blackwood with a raised shield cut on the back, kangaroo and emu for supporters, surmounted by a rose, with thistle on one side and shamrock on the other;' 'small round table of Huon pine with chess-board in the centre.' [Almost certainly the maker of item under 'Champion' above, see Watson 1993, Lake 2009.]

HART, Charles(?), Hobart: glue; neats' feet oil; oil from sheep trotters.

HAYNES, John, Hobart confectioner: various pickles – red cabbage, walnut, cauliflower, onions, 'mixed', tomato sauce.

HOOD, R.V., Hobart: silver wattle; muskwood; blackwood; Huon pine; myrtle; 'huron [sic] pine picture frame, with gilt moulding; the gold leaf made by Mr. Hood;' myrtlewood picture frame; 'gold leaf, manufactured from Californian gold; gold-beaters' skin.' [See also, Royal Society, below.]

HULL, Hugh, Hobart: 'Half section of the trunk of the Tolosa tree (*Pittiiscorum bicolar*). This is the wood of which the aborigines made their waddies or clubs.' [See also J. Milligan, below.]

INCE, W.H., London: 'A list of Australian birds, belonging to the late John Matthew Robert Ince, Esq., commander of H.M.S. "Pilot," and collected during the surveying service of H.M.S. "Fly".' [There followed a 43-strong listing. 'These specimens illustrate the ornithology of Van Diemen's Land as well as that of the Great Main of New Holland,' said the *Catalogue*, and expert advice (D. Abbott, pers. comm.) suggests that but few items were of Tasmanian provenance. Ince died soon after his Tasmanian sojourn, his father evidently instigating the exhibit].

JENNINGS, T.D., Hobart: Huon pine churn.

KEMP, George: cornelian, from the shore 'opposite Hobart'.

KERMODE, R.Q., Mona Vale: fine wool.

LIPSCOMBE, Frederick, Hobart: white Lammas wheat; dressed flax; ham ('cured by Mr. Marshall'); Huon pine table.

LOWES, T.Y., Hobart: *Mylitta Australis* [native bread], obtained at Glenorchy seventeen years ago; shark oil.

LUMSDEN, Andrew, Hobart: loo table-top, Huon pine, and pedestal.

McLACHLAN, Charles: specimen of 'silicised' [silicified] wood. 'This magnificent tree was discovered on the estate of Richard Barker, Esq. of Macquarie Plains; … it was 12 ft. high, and imbedded in lava, and distinctly surrounded by two flows of scoria, which at some distant day had brought out the juices of the tree to its surface, and because by a combination of silex [silica], completely vitrified, and surrounded the tree with a glossy surface, the interior of the tree producing opal wood. On a minute examination of the wood by Dr. [Joseph Dalton] Hooker, when here in the "Erebus," it has been discovered to be a species of tree not growing in the neighbourhood, and appears to be of the pine or coniferous species. It is conjectured it was originally thrown up by an eruption of a volcano to a considerable height and came down with its heavy end first upon a bed of sand and had there remained for ages. In describing the tree he says: — "The manner in which the outer layers of wood, when exposed by the removal of the bark, separate into the ultimate fibres of which it is composed, forming an amianthus-like mass on the ventricle of the stump in one place, and covering the ground with a white powder commonly called native pounce, is very curious." It is 10 ft. high, and when first discovered 3 ft. 6 ins. diameter, and has been excavated at very considerable expense and labour and was in a perfectly perpendicular position on the point of a ridge of rocks."

McKENZIE, Mrs. Flora, Bothwell: knitted gloves and lady's cape of opossum fur.

McNAUGHTAN, Alexander, Hobart: velvet wheat, white wheat; 'superfine flour'; muskwood; writing desk and dressing case, both made of muskwood, inlaid with blackwood, she-oak, and myrtle.

McPHERSON & FRANCIS, Hobart: wheat sample, 'weighing 65½ lbs. per imperial bushel'. [John McPherson and James Francis ran a provedore business; Francis seems the likely grower.]

MARRIOTT, Archdeacon F.A.: muskwood picture frame; walking-stick of Tasmania oak.

MARSHALL, George, Pittwater: wheat and oats.

MARSHALL, Hobart: whip and whip-thongs.

MILLIGAN, Alexander: 'biscuit, manufactured of Tasmanian flour.' [See also 'Gunn', above.]

MILLIGAN, Joseph: Sassafras bark ('used medicinally as a bitter and a stomachic'); hones for edged tools; resin of the grass-tree ('highly inflammable, yielding, on combustion, a clear white flame and rich fragrant odour, … said to be used in churches in place of frankincense; it dyes calico a nankin colour, and may become the basis of a varnish … very abundant in Flinders Island and neighbouring islands'); cross section of trunk of ironwood *Lignum vitae* ('the density and hardness of this wood is such as to have led to its application in making sheaves for ships' blocks'); carpenter's bench-screw; three pairs of shoe-lasts; 'necklaces of shells, as worn by the aborigines of Tasmania (The shell composing these necklaces seems to be closely related to the *Phasianella.* It is very abundant in the various bays and sinuosities of the island. It possesses a nacreous brilliant lustre, which is disclosed by removal of the cuticle, and this the aborigines' effect by soaking in vinegar, and using friction. Various tints, black, blue, and green, are afterwards given by boiling with tea, charcoal, &c.)'; all three volumes of the *Tasmanian Journal* [*of Natural History*]; snuff box, ironwood; ditto, muskwood; ditto, Huon pine; ditto ('globular'), from tooth of a sperm whale; ladies' thread-holder, turned; ladies' puff-box, turned; goblet, turned; 'section of *Richea pandanifolia*, obtained Macquarie Harbour … sliced, bevelled, and French-polished, to show the pith, medullary, rays and beautiful markings … grows like a palm and attains

the height of thirty to forty feet;' Macquarie Harbour pinkwood ('attains an elevation of from 100 to 150 feet, ... chiefly on the western side of the island... fine-grained and very hard, ... used for making sheaves' for ships' blocks'); Huon pine butter-churn; 'seven baskets made by the aborigines of Tasmania; four models of Aboriginal canoes made of the bark of *Melalueca squarrosa* which the natives used to cross to Brune Island,' 'model of a water-pitcher, made by the aborigines ... of the broad-leaved kelp, and is large enough to hold a quart or two of water. The only other vessel possessed by the aborigines for carrying a supply of water was a sea-shell, a large cymba, occasionally cast upon the northern shore of Van Diemen's Land, which contained about a quart'.

With Hugh HULL: kino from various eucalypts, 'said to be equal, as a medicinal agent, to the kino from the East Indies.'

MOSES, Samuel, Hobart: 'jaw of a sperm whale, with forty-eight teeth;' whalebone, 'an important export.'

MOSES, CHAMPION & Co: eight sperm whale teeth.

MURRAY, William, Hobart: box of starch ('there are now several starch manufactories in Hobart Town.'); box of Huon pine; mould candles.

OAKDEN, Philip, Launceston: two Leicester fleeces ('the produce of sheep imported from the best flocks in England in 1837, is exhibited to show the improvement in the softness and silky appearance of the fleece, which is attributed to the climate.')

PATTERSON, Hobart: malt, cask in wattle.

PECK, George: cribbage boards, veneered and inlaid.

PEARSON, Leonard, Hobart: pier table of polished blackwood. [See also Burgess, above.]

QUEEN'S ORPHAN SCHOOLS: woollen gloves; woollen socks and stockings; knitted shawl.

QUINN, M., Hobart: polished blue gum; maple veneer.

REES (REEVES?): 'wattle-bark, chopped, as it is prepared for the tan-pits'.

REEVES, I.G., Hobart: various leather samples including skins of kangaroo and calf; leather racks in horse ('cordovan') hide; 'skin-wool'. [See also Royal Society, below.]

REGAN, John, Hobart: Nine dressed kangaroo skins, tanned with wattle bark.

RICHARDSON BROTHERS & CO, London: two wool specimens.

ROBINSON, Charles, Westbury: gun-stock of polished blackwood.

ROLWEGAN, George, Hobart: 'Book printed and published in Van Diemen's Land, bound in colonial calf, gilt and letter with gold leaf manufactured in Hobart Town from Californian gold.' [This evidently was the first volume of the Royal Society's *Papers*, further noticed below.]

ROUT, William, Hobart: cheese; honey; linen; leather portmanteau; rope lines; four brushes. 'Tanned skins with the hair on of the *Thylacinus cynocephalus*.' 'The thylacine is peculiar to Van Diemen's Land, and as its ravages amongst the flocks of the settlers are as destructive as those of the wolf in other countries, it is hunted down with great perseverance, and will probably be the first of existing quadrupeds which will be extirpated.'; 'Six tanned skins of the *Ornithorhynchus paradoxus*. The platypus of the colonists.' 'Combines with the hair and fur of a mammalian quadruped, the webbed feet and the beak of a duck, while the male has spurs on its legs like a cock. In its internal anatomy ... offers many resemblances to both birds and reptiles and forms the nearest link in the mammalian series to the oviparous classes;' horsehair; honey; beeswax; 'in no country, it is supposed do bees thrive better than in Van Diemen's Land ... now become naturalized in the forests, and many of the hollow trees are filled with the produce'.

(COUNCIL OF) ROYAL SOCIETY OF VAN DIEMEN'S LAND: Volume One of its *Papers and Proceedings*. 'Printed by Messrs. Best, and bound by Mr. Rolwegan, Collins Street, Hobart Town. The lithographs by Mr. Thomas Brown[e], Macquarie Street ... Bound in colonial calf skin, tanned and dressed by Mr. Reeves. Gilt and lettered with gold leaf, manufactured from Californian gold, by Mr. Hood, Collins Street, Hobart Town.'

SCREEN, William, Hobart, ex-mariner publican: walking-stick, of whale bone, 'with round head and cut to resemble a man-rope knot'.

SHARLAND, Mrs. Frances, George Town: 'pressed algae, collected by the exhibitor'.

SHARLAND, W.S. [as agent of female kin?]: 'carriage-rug made of skins of the black opossum, lined with skins of the native cat;' 'thread lace, made by a girl eleven years of age.'

SLY, James, Hobart: pair of dress boots, in kangaroo skin and bullock hide.

SMITH, C.T.: hops; fine wool; cheese.

SMITH, Philip, Ross: wool.

SMITH, Naval Lieutenant: jams – raspberry and currant, green gooseberry, red gooseberry, quince; Epsom salts; wattle-tree gum from near Mount Dromedary ('equal to the gum-arabic of the shops').

STRACHAN, Richard, Bonnington: two boxes of salt.

STRUTT, William, Hobart: Marble from Maria Island, partially dressed.

SYMONDS, E., Hobart: corn, barley, willow rods, 'fire-screen for chair back,' of willow, locally grown, dressed and dyed; bottle basket; fishing basket; double-handed baskets; book basket; knife basket; child's basket; key basket, open basket, long basket, straw (from NI) hat; sieve hoop of Huon pine.

TIBBS, Charles: Hobart: crockery from Hobart's Domain clay.

TOOTH, Edwin, Bagdad: malt; lambs' wool gloves.

VALENTINE, William., Campbell Town: 'Three pieces of Huron [sic] pine, bored in the solid piece, with stops &c. (Two of these are bored in solid pine and are found to yield a softer and more mellow tone than those made of wood not so hard in the grain. It is considered that the tube, being free from joints and glue, and made of very durable wood, when properly seasoned, will be little influenced by atmospheric changes. The small pipe has a stopper, which being removed, an octave above will be produced. The stopped pipe is regarded as a novelty;

it gives a very soft note, well adapted for the treble half of the stop-dispance [diapason] of a chamber-organ. The third is exhibited to show how an open pipe of the usual construction may be tuned by means of a stopper, without injury to its use.)'.

VON STIEGLITZ, Mrs. Anne, Break O'Day: lady's cape of possum fur.

WALKER, Abraham, Norfolk Plains: plumbago (black lead); 'found ... in a shaft where lodes of lead and copper are expected to be realised'.

WALKER, John, Hobart: pearl barley; fine flour; white wheat; casks by a Hobart cooper named Johnson.

WARD, Charles, Hobart: 'Bushman's ankle-boots, of colonial material;' shoe-blacking.

WATCHORN, William, Hobart: tallow ('The exhibitor claims to have been the first to export tallow to England from the colony;' see below).

WATSON, John, Hobart: plank of blue gum, 146 feet by twenty inches by six inches. 'The various species of *Eucalyptus* attain generally a great size in girth and length in sheltered situations ... Blue gum has been measured upwards of 90 feet round near Tolosa, on the northern aspects of Mount Wellington range, and on the southern side ... 102 ft. at 3 or 4 ft. from the ground. Another *Eucalyptus*, called stringy bark, exists near the Cam River, on the north coast, measuring 64 ft. of solid timber at 4 ft. from the ground; the tree, having somewhat the form of a four-sided column with its angles bevelled, is 200 ft. to the first limb, where it is estimated to be more than 4 ft. in diameter, giving the enormous cubic measurement in the trunk alone of more than 1,000 tons of timber.')

WHITESIDES, James, Hobart: polished blackwood; myrtlewood; muskwood (Lake 2009).

WISEMAN, John, Hobart: whip, 'thong of colonial leather, and the stick a young sassafras of Tasmania;' 'two ladies' riding whips of whalebone, tipped with silver by Mr. [Charles] Jones; whip for stock-hunting; stock-hunter's saddle; stock-hunter's breastplate.

NOTABLE ITEMS

In the gaze of eternity, premier position must go to an item that scarcely met criteria for exhibition – the 'silicised wood' appearing under Charles McLachlan's name (pl. 4). The renowned J.D. Hooker was in Hobart as a member of the *Erebus* Antarctic venture in 1841, and this wood came to be discussed between him and Charles Darwin (Darwin 1845). McLachlan might have gone to pains to secure it for the Exhibition but exactly when the item was removed to London is unclear.

It transpired that ancient Vandiemonian timber won display, as did various specimens of the colony's latter-day timber. They received approval, notwithstanding the absence of John Watson's mighty plank. Perhaps yet more attractive were the items of art/craft in wood. William Hamilton is famed as a maker of fine furniture and the *Catalogue*'s notice of his exhibited chair told of its splendid conflation of imperial and local symbols. This style was to be adopted as its (continuing) insignia by the first Hobart municipal council – as explained below, a pro-Denison group, upheld by the ex-convict interest and its sympathisers. Hamilton was a free migrant, but that he allied with the municipal council's backers is further hinted by another work of his being exhibited by its owner, William Champion – very much a Tasmanian Union man, ex-convict and publican. The liquor interest was strong behind the Union, Champion's pub notable too for being a centre of local trade unionism, a modest but interesting element in the social mix.

Another free-migrant furniture-maker to exhibit was Andrew Lumsden. Britain's 'Antiques Road Show' television program reported that the table he exhibited in 1851 went spurned for decades, but that after its television appearance on the program it returned to Australia and was valued at up to £150 000 (Tassell & Morris-Nunn 1984, pp. 109–110; Crouch 1994). A similar Lumsden table brought some £30 in early 1960s Hobart and and fetched a thousand times that in 2011 (author's knowledge). One Launceston furniture-maker to exhibit was the talented John Brown, who in 1849 had proposed that his fellow-craftsmen should exhibit their wares in Britain. Of other exhibits in wood the most intriguing is William Valentine's 'Huron' pine organ-work.

Two 'gentry' ladies of local birth and Denisonian affinity presented items celebrating nature. The appeal of Emma Burgess's tapestry was embellished by a frame from another skilled wood craftsman, Leonard Pearson. Emma was born in 1827, daughter of James Ross, once the teacher of George Arthur's children and a commanding journalist of the colony's earlier days; her husband, Murray, was the son of a senior bureaucrat and himself able in like service. Frances (Schaw) Sharland was the daughter of an old-Eton soldier turned Arthurian administrator, and wife of W.S. Sharland, Legislative Councillor allied to the Governor. Her algae won 'unbounded admiration' from British savants. The Sharlands' daughter Julia (born 1837) was the likely eleven-year-old thread-lacer, and if so, then she was another native-born exhibitor. Anne von Stieglitz, Elisabeth Fenton and Flora McKenzie ranked among 'gentry', but were of overseas birth.

The girls from the Orphan School who contributed their handicrafts added to the story of femininity (and presumably native birth). Other pertinent women were inmates of the Cascades 'women's prison' whose tweed appeared under Denison's name – the sole obvious convict contribution, although that was not spelt out. The preserved meats of Mrs Adcock, illiterate spouse of a Hobart 'pork butcher', might seem a mundane offering, yet a London journalist saw them as promising Australia's capacity to boost the livelihood of British workers, and her produce won further praise (*The Courier* 4 February 1852, p. 4). For posterity, much more important were items entered by Joseph Milligan, as Superintendent of the Aboriginal station at Oyster Cove. Aboriginal women surely had the greater part in making the baskets, shell necklaces and kelp water-pail (pl. 5), but like the

Orphanage girls and Cascades women (and the putative Sharland daughter too), they were all anonymous.

Leatherware's chief protagonist was I.G. Reeves, who claimed in May 1851 that the product had garnered £30 000 in exports through the past year. A free migrant, Reeves was ultra-active in pro-Denison politics; the speech exalting leather (and also citing the Exhibition as an 'imperishable monument of the industrial arts') belonged to that story. Reeves further appeared in the *Catalogue* for his calf-skin binding of the Royal Society *Papers*. After leaving the island he won election to Victoria's Legislative Assembly.

PRAISE FOR THE COLONY

That Tasmania's effort achieved Denison's purpose has been this paper's theme, and various commentators spoke to appropriate effect. Prime among them was Secretary of State Earl Grey. Speaking in the House of Lords, on 9 May 1851, Grey said of the island, 'considering its population it made a better show than any other colony that we possessed' (*House of Lords Historical Hansard* 9 May 1851; Denison & Denison 2004, p. 161). Lady Denison remarked on being 'mightily pleased at this, partly because I am very anxious for the honour and credit of this colony, but chiefly because I think it is in great measure due to William that we have succeeded so well'.

Less partial opinion yet echoed Grey's approval. Overall, the Empire did not rally all that strongly to the Exhibition, succumbing to such difficulties as the Earl himself had seen likely to disbar Van Diemen's Land (Hollingshead 1862, Auerbach & Hoffenberg 2008). Sheer bulk showed the island's effort – thence came 80 'packages' to London as against, for example, 12 from New South Wales, and 29 from South Australia. Occupation of space in the Crystal Palace echoed these statistics, and the story went beyond numbers. A *Sydney Morning Herald* correspondent from London told that 'We must give our sister Tasmania the *pas*, whether as regards the number of her contributors or the ability and care with which the descriptive part has been

McLachlan, —.

348 Specimens of silicized wood from Van Diemen's Land.

[This magnificent tree was discovered on the estate of Richard Barker, Esq., of Macquarie Plains, Van Diemen's Land, 32 miles from the City of Hobart Town, in the district of New Norfolk; it was 12 ft. high, and imbedded in lava, and distinctly surrounded by two flows of scoria, which at some distant day had brought out the juices of the tree to its surface, and became by a combination of silex, completely vitrified, and surrounded the tree with a glossy surface, the interior of the tree producing opal wood. On a minute examination of the wood by Dr. Hooker, when here in the "Erebus," it has been discovered to be a species of tree not growing in the neighbourhood, and appears to be of the pine or coniferous species. It is conjectured it was originally thrown up by an eruption of a volcano to a considerable height, and came down with its heavy end first upon a bed of sand, and had there remained for ages. In describing the tree he says:—"The manner in which the outer layers of wood, when exposed by the removal of the bark, separate into the ultimate fibres of which it is composed, forming an amianthus-like mass on the ventricle of the stump in one place, and covering the ground with a white powder commonly called native pounce, is very curious." It is 10 ft. high, and when first discovered, 3 ft. 6 ins. diameter, and has been excavated at very considerable expense and labour, and was in a perfectly perpendicular position on the point of a ridge of rocks.]

PLATE 4 — The exhibits of silicised (petrified) wood attracted much attention; the magnificent specimens were originally collected from Macquarie Plains near New Norfolk (Catalogue 1851, Vol 2, p. 999).

executed.' London's *Morning Herald* made a like colonial comparison and judged that 'Van Diemen's Land has a much larger and more varied display and has already made considerable advances in native manufactures'. Another London voice declared that 'Van Diemen's Land sends by far the most complete and valuable collection from the Australian colonies', while *The Illustrated London News* affirmed that 'Van Diemen's Land makes a gay display of fancy woods and 'possum skins'. A further commentator praised the colony's advance in 'native manufactures', somewhat surprised that 'worsted work should be sent to the Exhibition from the antipodes'. Scientific luminaries applauded Milligan's work as presenting 'the most clearly arranged and the most explanatory of all the catalogues', while a popular *Guide to the Great Exhibition* affirmed that the Vandiemonian display:

> *... is most satisfactorily abundant in its ocular evidences of civilization. Their cloths, preserved meats (beef-steak to wit! [Mrs Adcock's second hit]), enamelled hides and excellent furniture, almost equalling our own for make and taste of execution, are triumphant proof of the progress of knowledge and industry over brute force and self-contented un-intellectuality.*
> (Routledge & Co 1851, pp. 121–122)

Appropriate to all this was John Tallis's inclusion of a stunning map of Tasmania in the newly published *Illustrated Atlas and Modern History of the World*, celebrating the Exhibition (Tallis & Martin 1851, p. 59).

ABORIGINAL CONCERNS

At least one British voice was different, protesting the fate of the island's 'now extinct Aborigines':

> *In our forty years' possession of that settlement we have utterly destroyed them, by as atrocious a series of oppressions as ever were perpetrated by the unscrupulous strong upon the defenceless feeble. Yet these poor people had tastes and industry too. Their bread appears to be worth reviving as a new truffle for soup by the gourmands of Hobart Town. The specimen of the root exhibited weighs 14lb. They obtained a brilliant shell necklace by soaking and rubbing off the cuticle, and gaining various tints by hot decoctions of herbs. They procured paint by burning iron ore and reducing it to powder by grindstones. They converted sea-shells and sea-weeds into convenient water-vessels; they wove baskets' and they constructed boats with safe catamarans. All these things are exhibited. Surely, then, the men whom their greedy supplanters admit to have done this, and whom the least possible pains ever bestowed upon them proved to be capable of much more, ought not to have been hunted down, as we know they were, and then almost inveigled to be shut up in an island too small for even the few remaining.* (*The Courier* 3 September 1851, p. 3, quoting from *The Illustrated London News* 24 May 1851)

This remarkable piece appeared in *The Illustrated London News*, and duly in Hobart's *The Courier* – without comment, a loud silence.

PLATE 5 — Model canoe and kelp water-pitcher made by Tasmanian Aborigines and sent by J. Milligan to the Great Exhibition. Associated information provided with the images. **A**. Model canoe, or catamaran, made from *Melaleuca squarossa* [tea-tree] and *Leptospermum* [paper bark] bark. Made from bundles of bark, tied together with plant fibres. Both tips are broken with one tip detached. Height 26.40 cm, width 16.50 cm, depth: 78.20 cm. The model was exhibited at the 1851 Great Exhibition at the Crystal Palace, London: catalogue number 282. **B**. Water vessel made of Bull Kelp (*Durvillaea potatorum*) consisting of a single piece of dark brown coloured kelp. Sides are gathered together, and wooden sticks passed through the folds, preserving its shape. Handle is of twisted fibre, knotted together near the centre. British Museum Asset number 1613713295, image released under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0) license.

MEDALS AND AWARDS

The honours-awarding juries ignored such tragedy and awarded medals and certificates (*Report of the Commissioners* 1852). The Exhibition Medal was reported to be one of the most magnificent ever produced by the celebrated firm of Allen and Moore from Birmingham (*Hobarton Guardian* 22 October 1851, p. 3), (pl. 6). A consolidated list of locals appeared in *The Courier* (14 May 1853, p. 3), although some ambiguities remain (Royal Society of Tasmania 1854, pp. 490–492). Probably Tasmania's overall record was barely above average – yet that sufficed. Denison and Milligan both received 'Prize Medals' for their services, and further ones for their contribution: minerals and rocks specified in the former instance and 'raw materials' in the latter (doubtless referring primarily to timber, but 'his' Norfolk Island pepper also scored at this level). Further prize medallists were Boyd, Brownrigg, Douglas River Coal Company, Dowling, Fowler, Hadden, Hood, McNaughtan, McPherson & Francis, Alexander Milligan (as agent for W.B. Dean—see below) and Whitesides. Honourable Mentions went to Akers, Boyd, Brown & Company, W. Button, Denison (for Norfolk Island's arrowroot and blood-juice), Dixon, Euston, Freeman, Grant, Hull (woods), Lipscombe (for both his own flax and Marshall's ham exhibited by him), J. Milligan (for unspecified 'produce'), Moses, Murray, Quinn, Rolwegan, Rout, Smith (the Naval man, for his gum), Tooth (for his malt) and J. Walker. Then came 'Exhibitor's Medals' which were bestowed upon Adcock, Armstrong, Barnard, Bicheno, Brown, T. Button, Champion, Cleburne, Fraser, Dixon, Gunn, Hamilton, Hood, Hull, Kermode, Lowes, McKenzie, G. Marshall, Moses, Murray, Patterson, Pearson, Marriott, Peck, Reeves, Robinson, C.T. Smith, P. Smith, Strutt, W.S. Sharland, Symonds, Thomson, Tibbs, Valentine, A. Walker, J. Walker, Ward, Wiseman. Virtually all the rest got a certificate. One went even to non-exhibitor John Watson while the Bridgewater model was ignored. Further lessening confidence in the judges is their placing in the lowest category such people as Lumsden, Frances Sharland and George Rolwegan.

The jurors' commentary rarely went beyond the obvious (major citations included minerals generally and Douglas River coal especially; wheat, flour and biscuit; flax and apples; pickles, sauces, resin and gums; Norfolk Island products including 'blood juice' as dye-stuff; honey; woods generally, walking sticks and snuff boxes). One near exception lay in praising Denison and others for a 'very remarkable and interesting collection of the woods of Van Diemen's Land'. Specifically praised was the blackwood (*Acacia melanoxylon*) – 'the beauty of this fine wood is admirably shown in some of the articles of furniture, in which its dark hue is well contrasted with the equally beautiful light wood of the Huon pine'. The variety of materials used for snuff-boxes provoked comment, with a side-remark that whale-teeth were also used for 'stick-heads and similar purposes'. Applause for Norfolk Island's produce extended to its coffee, 'a most desirable novelty'. It went thus for McPherson & Francis's wheat and Dean's biscuit, the latter's excellence contrasted with poor British stuff recently being supplied to naval ships and convict transports. (Before migrating, Dean had made biscuit at the Royal Arsenal, Deptford.) A further reference cited 'good, dried apples grown in the colony' obviously Dixon's; pickles and sauces, obviously Haynes's, also were commended. While gaining no award, Ince's ornithology was cited as an exemplar of 'cultivation of science by the officers of the British Navy'.

Another verdict honoured nutriment of the mind (*Report of the Commissioners* 1852, p. 407, complemented at p. 426 (Rolwegan's bookbinding) and p. 452). 'The jury have examined, with real interest, several works printed in Van Diemen's Land, at Hobart Town, several of them by Henry Dowling, such as the Tasmanian Journal [*of Natural Science*],' went a soliloquy; 'Print is a gift almost as necessary to man as speech, for the manifestation of his thoughts'. An almost-explicit message went that the distant colony had recognised such profundity, whereas overall like work made a poor showing at the Exhibition. In mistaking Dowling's home-place, the jurors failed to recognise this major contribution from Launceston. Their compliment presumably embraced the Royal Society's first *Papers*, printed by Dowling and melding skills of 'Daguerreotype and Lithographic Artist' Thomas Browne, the similarly expert R.V. Hood, and bookbinder Rolwegan (its putative exhibitor), not to mention learned authors. All were heroes of Vandiemonian culture.

AFTERMATH

After its amazing success, the London Exhibition closed on 15 October 1851 and Tasmanian exhibits (like all others) had to be deployed. Queen Victoria accepted the Royal Society's *Papers* (see *Examiner* 31 March 1852; receipt of thanks from British Museum and Linnaean Society at Royal Society meetings, February and July 1852; *Examiner* 22 May 1852 (Geological Society), *Examiner* 31 March 1852 (proposed 'National Museum'); *Report of the Commissioners* 1852, pp. 165–171 has material relating to a proposed 'Trade Collection', seemingly the founding idea behind the Sydenham project; an extensive list of promised items from Tasmania appears). Minerals went to the Geological Society of London, other items to the Linnaean Society, the British Museum, and the display that continued in the Crystal Palace when re-located (until 1936) to suburban Sydenham. Today the British Museum holds at least the 'silicised wood' and most of the Aboriginal artefacts. 'To see those [objects] that were made by people during colonial times raises our spirits and warms our being,' Patsy Cameron said of the latter when they toured Australia in 2014 (https://www.nma.gov.au/exhibitions/encounters). After the exhibition on their return, the shell necklaces were included in an 'Indigenous Australia' exhibition at the British Museum.

Charles McLachlan probably was happy to deal with prestigious disposals, but rank-and-file items proved burdensome (TA CSO 24/1/173/5010). Exhibitors had been asked in advance whether they wanted their goods to be sold or to name recipients in Britain. Sales were

PLATE 6 — The Bronze Exhibitor Medal awarded to many exhibitors. Medal held at the Tasmanian Museum and Art Gallery (size 44 mm diameter, Accession number T469). (Image from https://shapingtasmania.tmag.tas.gov.au/object.aspx?ID=80)

negligible, save that one table (almost certainly Lumsden's) brought £5. Denison's hopes for benefit to orphan children doubtless withered. McLachlan wrote in November that he had been sending off remittances 'down to the pair of boots for "Elizabeth Brown at the Shoulder of Mutton, opposite St Andrew's Church, Ipswich, England"'. All this had incurred some £100 debt. He had distributed copies of Milligan's *Catalogue* data to various parties 'interested in the welfare of the colony' and concluded (in telling words) that

> *Canada stood first in the list and Van Diemen's Land second, in the productions from the British Colonies, but both had a political object in view, the former to induce Emigrants to go to that Colony, the latter to show what a Convict Colony can do … I have now closed the (to me) very troublesome matter, in which there has been a great deal of work with but little thanks from any quarter.*
> (McLachlan, TA CSO 24/1/173/5010)

Thanks, however, did come from the Royal Society of Tasmania, and expenses were met. Another sour note in McLachlan's letter told that award of prizes had caused such ill-feeling as to make the Commissioners regret having so embarked. If the judges' grading of Tasmaniana was indicative, critics had reason for complaint.

As the Exhibition proceeded in London, it kept a place in Vandiemonian affairs. At a massive anti-transportation meeting in July 1851 John West deplored that at the Crystal Palace there 'would be concentrated the productions of the labour of free men in [all] the quarters of the globe, except a few contributions from Van Diemen's Land' (*The Courier* 16 July 1851, pp. 1–3, 1 October 1851, p. 2 ('rhetoric'); *Tasmanian Colonist* 20 November 1851, p. 1 (Watchorn)). Whereas Lady Denison enthused at Earl Grey's applause for local effort, *The Courier* disparaged it: 'to such paltry shifts of rhetoric are our rulers driven to find a defence of their policy'. The paper to give most regard to the Exhibition was a newcomer, the *Hobarton Guardian*, owned by John Davies as he became a hero among erstwhile convicts. October 1851 saw the anti-Denisonians victorious at the first polls for a part-elective Legislative Council. (An unsuccessful candidate was William Watchorn, whose tallow appeared at the Exhibition. A campaign lithograph presented Watchorn as 'Old Greasy'. At a campaign meeting Watchorn 'asked if his name was to be vilified and abused for sending to the Great Exhibition the fat of the land'. Here he was interrupted by tremendous peals of laughter').

The new legislature soon heard criticism of the Royal Society for being 'exclusive', the Society's link with Denison probably feeding this animus. Yet 1852 added to the Exhibition's honour. Early February heard news of awards to locals of 'prize medals' (*The Courier* 15 September 1852, p.3, and 17 November 1852, p. 2). Public lectures applauded the Exhibition as evidence of a 'growing spirit of universal philanthropy and benevolence' and 'progress of civilization, refinement, and social happiness.' In September the actual medals arrived, honoured at a Royal Society meeting for 'beauty, … elegance, … high finish'. Local talk, perhaps well-founded, now declared W.B. Dean's biscuit and McPherson & Francis's wheat to have ranked superior above all Exhibition competitors.

Political action went in step. September–October 1852 saw the organising of a massive petition that told the Colonial Office of support for Denison. Now, too, Victoria's legislature passed an Act forbidding entry thither of conditionally pardoned ex-convicts (Petrow 2012). Hobart's pro-Denisonians responded with furious and justified vehemence. One mighty protest saw the Governor and his lady attend, to massive cheers. 'The arrangements … were looked upon by our colonists much in the same light as the people of England viewed the Great Exhibition,' one

organiser said, nicely linking that event with local politics (*Hobarton Guardian* 18 December 1852, pp. 2–3). The protest belonged to a campaign by pro-Denison, anti-transportation candidates for the first election of municipal councils in Hobart and Launceston. On 2 January this party triumphed in the capital.

Although news might have percolated earlier, not until May 1853 did there come the remaining medals and certificates, together with (for every exhibitor) books of jurors' reports (*Report of the Commissioners* 1852, *The Courier* 14 May 1853, pp. 2–3, Denison & Denison 2004, p. 213). The generally distributed item was a compacted *First Report of the Commissioners 1852* published by Clowes and Sons, London. Presentation sets comprised a four-volume version of the *Catalogue*, four of *Reports of the Juries*, plus *First Report of the Commissioners* (*The Courier* 17 December 1853, p. 2). In September, Lady Denison wrote of yet further bounty: 'a most beautiful illustrated catalogue and history of the great Exhibition, in eight or nine immense volumes splendidly bound … we have had so much amusement in looking over these beautiful books before transferring them to the public library.' (Denison & Denison 2004, p. 213). The items remain phenomenal – enormous, and luxuriant in gilt, plush, leather, and illustration. The series was displayed at a Royal Society meeting in December 1853, together with a case holding samples of the various award medals. Three of the giant books remain in the State Library of Tasmania and the medal case remains at TMAG.

Against these positives there stood a story illustrating the tensions that Charles McLachlan had told to follow from prize awards. As already shown, the fine Exhibition biscuit made by Launceston baker-businessman W.B. Dean was submitted under the name of Alexander Milligan, Secretary of the northern committee. When prize medals arrived in September 1852 one was designated for Milligan. He might have thought he had earned it, but Dean demanded what indeed was *his* award, threatening physical force and legal action. Milligan soon forwarded the medal, with apology. Dean continued angry and the issue revived in mid-1853 after the arrival of those further rewards. Milligan again kept what Dean saw as due to himself, and resiled only after more lawyer-talk. All this Milligan told to the *Launceston Examiner*, which had broached the issue in terms sympathetic to Dean (*Launceston Examiner* 28 June 1853, p.5, 2 July 1853, p. 672).

The alliance between Denison and commoners lasted throughout his term. Its later stages saw the 'Oddfellows' Friendly Society become important in bonding such Hobart people as had earlier joined the Tasmanian Union and voted the winning municipal ticket. Current Oddfellows' head was Charles Jones, ex-convict, skilled silversmith, publican and contributor – via Wiseman's whips – to the Exhibition (O'Driscoll 1987). While already *patron* of the Oddfellows, Denison was inducted as a *member* just before leaving the island in January 1855 to become Governor of New South Wales and Governor-General of the Australian colonies, the Exhibition chapter perhaps helping to win him such promotion. Venue for the Oddfellows' induction was Government House, with Jones officiating: so strange Van Diemen's Land could be! Oddfellows dominated the continuing farewells to the Governor and surely gave much of a £2000 testimonial now presented to him. The money duly funded what Denison described as 'a very magnificent silver centre-piece embodying in addition to the old stereotyped forms, groups characteristic of the employment of the people or of the nature of the productions of the country' (meaning Tasmania). Whaler, shepherd, sawyer, splitter, ploughman, kangaroo, emu, platypus, 'sassafras and other native shrubs' – all were there. The motifs were chosen by Denison, their resonance with the Exhibition quite likely deliberate.

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VEGETATION CHANGE IN AN URBAN GRASSY WOODLAND SINCE THE EARLY NINETEENTH CENTURY

by Ellen R. Sorensen and Jamie B. Kirkpatrick

(with two text-figures, one table, eighteen plates and three appendices)

Sorensen, E.R. & Kirkpatrick, J.B. 2021 (15:xii). Vegetation change in an urban grassy woodland since the early nineteenth century. *Papers and Proceedings of the Royal Society of Tasmania* 155(2): 37–54. ISSN 0080-4703. School of Geography, Planning, and Spatial Sciences, University of Tasmania, Private Bag 78, Hobart, Tasmania 7001, Australia. (ES and JK*). *Author for correspondence. Email: j.kirkpatrick@utas.edu.au

Our understanding of the history of vegetation change after the British invasion of Tasmania is limited. The Queens Domain in Hobart is an area of remnant grassy woodland that provides the opportunity to document such vegetation change and its causes using historical images and reports. Tree removal, stock grazing, and the consequent reduction in the incidence of fire appear to have resulted in a decline in tree cover after European settlement, reaching a nadir during 1861–1880. Paintings and photographs indicated a sharp increase in tree cover between 1921 and 1941, associated with the banning of stock grazing. This increase appears to have been encouraged, rather than hindered, by the increasing frequency of low-intensity fire resulting from a reduction in grazing pressure.

Key Words: artwork, Queens Domain, grassy woodland, stock grazing, burning, Tasmania, vegetation reconstruction, disturbance regime.

INTRODUCTION

The vegetation created through management by Indigenous peoples has been much modified since the British invasion of Tasmania (Kirkpatrick 1994, Fletcher *et al.* 2020). Clearance of land for agriculture has been the major impact. Among the ecosystems most suited to agricultural pursuits have been the temperate grasslands and grassy woodlands, the remnants of which are among the most modified ecosystems in Australia (Kirkpatrick *et al.* 1995).

The Queens Domain (the "Domain") is a remnant of grassy woodland in inner-city Hobart, Tasmania, Australia. Since the 1960s there has been a well-documented transition from *Eucalyptus viminalis* grassy woodland to *E. viminalis-Allocasuarina verticillata* woodland/forest or *A. verticillata* open/closed forest over much of the Domain (Kirkpatrick 1986, 2004, Kirkpatrick *et al.* 2007). The woody thickening documented for the Domain since the 1960s has also occurred on coastal sand dunes (Hayes & Kirkpatrick 2012, Guy & Kirkpatrick 2018), in coastal heath (Bargmann & Kirkpatrick 2015) and in grasslands and grassy woodlands elsewhere in Tasmania (Kirkpatrick *et al.* 2007, Romanin *et al.* 2016). The openness of woodland and forest vegetation in the mid-twentieth century has been postulated to be the result of a combination of burning and heavy grazing, with the removal or reduction of either or both disturbances allowing woody thickening to occur (Kirkpatrick *et al.* 2007). Grazing following burning promotes lawn grassland (Leonard *et al.* 2010) and may eliminate or reduce woody regrowth (Roberts *et al.* 2011, Hazeldine & Kirkpatrick 2015). The vegetation changes on the Domain that occurred between European settlement in 1803 and the 1960s have not been systematically documented. In fact, there is a dearth of centuries-scale documentation of changes to the ecosystem post-colonisation in Australia, with a tendency to instead compare the present vegetation to a pre-European baseline (Lunt 2002). While these comparisons are useful for understanding changes to vegetation patterns, they can overlook the fact that present patterns are a result of past actions (Lunt 2002). Grasslands and grassy woodlands in Australia have been particularly subjected to changes to disturbance regimes post-colonisation due to the ease with which they could be used for agriculture. They are therefore well-represented within the literature on pre-invasion vegetation (e.g., Fensham 1989, Lunt 2002).

Common sources for historical vegetation reconstruction include government records, maps, surveyors' reports, management plans, aerial photographs and anecdotal communication. The accuracy of the vegetation reconstruction is dependent on the quality of the sources (Shea *et al.* 2014, Yang *et al.* 2014, Sevara *et al.* 2018, Beller *et al.* 2020). The Queens Domain has a wealth of written and photographic historical material from which to extract information about vegetation change, land use change, management regimes and ecological processes that have occurred over the past two centuries. This paper builds on the general historical observations of Terry (1999), Sheridan (2002) and Cahalan (2016) to establish the history of structural change in the vegetation of the Domain by comparing the historic vegetation with the current state, and an analysis of temporal changes in tree cover, based on artworks and photographs (app. 1). We relate these observed changes to variation in disturbance regimes deduced from printed information. The purpose of this work is to bridge the gap in knowledge of disturbance regimes and their impacts on native vegetation from the time of British invasion to the decade-scale analyses of vegetation change undertaken by Kirkpatrick (1986, 2004).

FIG. 1 — The Queens Domain, Hobart. 526487 E 5254165 N, GDA2020/MGA55. (Source: LIST map)

History

The area has been known variously as the Government Domain, the Queens Domain and the Government Paddock (Cahalan 2016). The term "domain" refers to the grounds associated with the residence of the Governor (Terry 1999). The area was chosen as the location of Government House in 1811 by Governor Lachlan Macquarie (Terry 1999). However, the people of Hobart considered the area to be a "common" and responded angrily to the Government's attempts to exclude them and to the "alienation" of the area for various industries, such as slaughter-yards and quarries (Cahalan 2016). Calls for the Domain to be made "inalienable" began as early as 1836 (*The Hobart Town Courier* 23 Sept. 1836, p. 4; app. 2.1). The Domain would eventually be made inalienable through the *Queen's Domain and Launceston Swamp Bill 1858*, the same year that the construction of Government House was finished (Terry 1999). However, parts of the Domain were still developed, and by the twentieth century the Domain would house several quarries, the shipyards, two cricket grounds, the Beaumaris Zoo, the Royal Tasmanian Botanical Gardens, a railway and the University of Tasmania (Terry 1999). The Queens Domain Improvement Committee was formed in 1875. It consisted of members of the Royal Society of Tasmania with an interest in the management of the Domain, many of whom were influenced by the English park-like ideal of landscape design (Terry 1999). This committee was given legal power through the *Queen's Domain Committee Act 1889*, reporting to the Minister for Lands and Works (*The Mercury* 25 Sept. 1889, p. 3; app. 2.2). In 1917, management of the Domain was transferred to the Hobart City Council, where it remains today (Inspiring Place 2013).

METHODS

Study area

The Queens Domain is an urban park located in Hobart, Tasmania (42°52'07.74" S 147°19'49.31" E, fig. 1), with a maximum elevation of 90 m. The underlying geology is predominately Jurassic dolerite, on which dermosols form, with some Tertiary lacustrine sediments along the foreshore (Kirkpatrick 2004). The current area of the Domain is approximately 230 ha (Inspiring Place 2013). The boundary of the Domain has changed throughout the centuries (pl. 1) and once encompassed approximately 260 ha (Sheridan

PLATE 1 — Close up of the Queens Domain taken from *Plan of Hobart and its vicinity – Battery Point & Domain Point are copied from Mr Scott's survey the remainder by W. S. Sharland*, 1827. Digitised image from Libraries Tasmania, https://stors.tas.gov.au/AI/AF394-1-4.

2002), with much of the loss resulting from clearance for roads and other uses. Some locations discussed in this paper therefore may no longer fall within the boundaries of the present Domain, which currently includes the Royal Tasmanian Botanical Gardens, Government House, its grounds and the Cenotaph as well as the bush and sport grounds, but not the Brooker Highway or the University of Tasmania campus buildings. In this work, we have primarily investigated any parts of the Domain that at any time were covered with predominantly native vegetation.

The Domain is bordered by the Derwent River to the east and ringed by the Brooker Highway which provides access to the city suburbs and greater Hobart area. The most dominant plant communities according to TASVEG 4.0 are *Eucalyptus viminalis* grassy forest and woodland (DVG), *Allocasuarina verticillata* forest (NAV), *Eucalyptus pulchella* forest and woodland (DPU), *Eucalyptus globulus* dry forest and woodland (DGL), and lowland *Themeda triandra* grassland (GTL) (DPIPWE 2020).

Data collection and analysis

Historical images and written records referring to the Domain were accessed using Trove and Libraries Tasmania (https://trove.nla.gov.au, https://libraries.tas.gov.au, accessed June–October 2020). The plates used to estimate changes in vegetation cover over time are provided in appendix 1. A list of all newspaper sources including article title describing existing vegetation and changes in management on the Domain are provided in appendix 2. Appendix 3 contains a list of all the historic images used in the comparative analysis of changes in vegetation over time. These images were organised into a geographic region based on the area depicted in the image, or where the image was taken, these categories being *Domain West, Domain East, Domain North, Domain South, Entire Domain* (comprising paintings where all or a large part of the Domain could be seen, as well as aerial photographs), *Foreshore,* and additional categories for *Government House* and *Botanical Gardens.* While the landscapes of the Botanical Gardens, Government House and other human infrastructure are an important part of the history of the Queens Domain and make up a substantial portion of the photographic record, images of these locations were only included in subsequent analyses insofar as they depicted the native vegetation. The outline tree cover visible in images was estimated to the nearest ten percent. Where there was sufficient clarity in the images, a determination of vegetation community was made. The images were divided

into time periods, mostly of 20-year intervals. The mean cover of trees was compared between these time periods using one-way analysis of variance with Tukey's test in the statistical computer program Minitab (Version 16). Images with insufficient tree cover information or inexact dates were excluded from analysis. The total number of images included in the analysis was 92.

The images were analysed to establish whether there were sufficient geographic features or landmarks present to determine an approximate location for repeat photographs. Google Earth Terrain View was used to gain the approximate GPS locations from which the original images were taken. Six sites were then chosen for rephotographing based on our confidence in the image location, and the evenness of their distribution across the Domain. Two images were taken from the western side, two from the eastern side, and one each in the north and south. On the ground, the approximate locations were then cross-referenced with the historical images. The dominant plant species and vegetation structure were recorded.

RESULTS

Five of the six rephotographed locations showed an increase in density compared to its historic state, with one location being the same (table 1). The nineteenth-century understoreys were largely dominated by grasses with few or no understorey shrubs. In the late twentieth century there was a transition from open grassy woodland to shrubby *E. globulus-E. pulchella* forest and woodland in the west, from open grassy woodland to *A. verticillata* forest on the east, and from open grassy woodland to *E. viminalis-E. globulus* grassy forest and woodland in the south. In the northern section, the vegetation changed much less than elsewhere.

There was significant differentiation in tree cover between time periods (ANOVA, $F = 3.45_{8,83}$, $P = 0.002$). Between 1841 and 1901 the mean cover for all periods was significantly less than that for the 1991–2020 mean. The period of lowest tree cover occurred from 1861 to 1880 (fig. 2). Tree cover was highly variable within periods in the nineteenth century, with a gradual decrease in mean cover until 1861–1880 (fig. 2). Mean cover was then low until 1901–1920, then increased dramatically in the next two periods (fig. 2). The last two periods had high levels of mean cover and low variability (fig. 2).

Pre-colonial and early colonial era

Reconstructing the landscape of the Domain prior to European occupation is challenging as there are no depictions or descriptions of its vegetation prior to British invasion. The Domain was occupied by the muwinina Aboriginal people, with records of shell middens on the eastern shoreline indicating that the site was used for at least 5000 years prior to colonisation (Kerrison & Binns 1984). The vegetation structure at the time of colonisation was likely to have been woodland or grassy woodland which is likely to have been maintained by patch burning by the muwinina people and grazing by native herbivores (Kirkpatrick 2004). The native tree composition is likely to have been similar to that of today.

A general picture of the vegetation surrounding the Sullivans Cove colony can be gained from James Backhouse Walker who, working from the diaries and letters of the early colonisers, described the area around the settlement as consisting of "... dense tangles of tea-tree scrub ... with ... huge gum trees, ... and ... slopes covered with trees" (Walker 1889, p. 226). The area of the creek which formed the Domain's southwestern border was described as a "swampy flat" with the beach running round the "wooded slope" to what is now Macquarie Point (Walker 1889, p. 226). Later sources refer to the Domain being "wooded down to the very beach" in the early years post-colonisation (app. 2.3). The *View of Sullivans Cove* (possibly by George William Evans 1804, pl. 2) depicts the initial camp in the Sullivans Cove settlement, with trees shown in the foreground on the southwestern shoreline of what would become the Domain.

In the early years after colonisation the Domain is described as being "in a state approaching nature" and "well-wooded with natural trees" (app. 2.4) as well as "park-like lands [...] which never carried timber and scrub very thickly" (app. 2.5). Land clearance occurred shortly after colonisation, with four allotments totalling over 20 ha granted on the southern foreshore area between 1804 and 1805. Early clearing can be seen in a rough sketch made by Deputy-Surveyor G.P. Harris entitled *Hobart ca. 1805* (pl. 3). No further allotments were granted after the Domain was claimed for the Government in 1818 (Terry 1999).

Tree removal has been a major disturbance throughout the European use of the Domain, occurring "as soon as the tents were pitched" after the arrival of the early colonists (Walker 1889). Individual settlers were permitted to remove trees on the Domain for firewood and other uses until 1816 (app. 2.6). The practice continued illegally in subsequent decades to such an extent that it was feared the Domain

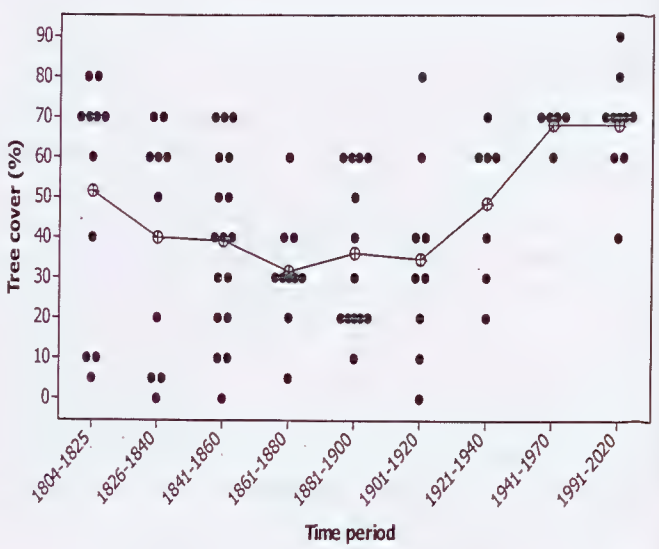

FIG. 2 — Change in tree cover depicted on images between periods. The line connects the means for periods. Each dot represents an individual image.

TABLE 1 — Comparison of vegetation between historic images and 2020

Title of image (appendix and plate reference)	Year	Location	Vegetation	Tree cover estimate	2020 Vegetation	2020 tree cover
View from the Domain looking N.W across New Town Bay, Bellevue in foreground (app. 1, pl. 7)	1826–1853	North	Open grassy woodland. *Eucalyptus* sp., in tree layer, height estimate between 8–15m. *Allocasuarina verticillata* seen in understorey and in background. Some tussocks can be seen.	60%	Open grassy woodland, tallest layer dominated by *E. viminalis* with scattered *E. globulus*.Understorey consists of juvenile eucalypts, *Allocasuarina verticillata, Exocarpos cupressiformis, Acacia mearnsii,* both adult & juvenile. Range of native grasses (*Themeda triandra, Poa* spp.) in understorey.	60%
Government House, Hobart Town, and the River Derwent from the Domain (app. 1, pl. 9)	1866	South	Open grassy woodland land with scattered *Eucalyptus* sp., in tree later. Range of heights to >12 m. Understorey grass-dominant with small shrubs.	30%	*E. viminalis- E. globulus* forest and woodland. Understorey of *Bursaria, Allocasuarina verticillata, Acacia melanoxylon, and Acacia mearnsii.* Various native grasses including *Themeda triandra, Poa* spp., *Lomandra longifolia.* Large amount of fallen branches, bark, leaf litter.	50%
Cornelian Bay, Hobart (app. 1, pl. 11)	~1890	East	Open grassy woodland with tussocks and scattered *Eucalyptus* spp. *Allocasuarina verticillata* and *Bursaria spinosa* in understorey.	10%	*Allocasuarina verticillata* forest with scattered *E.viminalis.* Understorey consists of *Bursaria spinosa* and *Acacia mearnsii.* Grasses include *Themeda triandra., Poa* spp., *Lomandra longifoilia.* Many *Allocasuarina verticillata* seedlings. Lots of litter from *Allocasuarina. verticillata.*	60%
View of Hobart from the Domain showing Campbell Street and the Park Street intersection (app. 1, pl. 13)	~1900	West	Tree layer of *Eucalyptus viminalis* and *E. pulchella,* tall and large in diameter. Grassy understorey, no shrubs or small trees.	10%	Shrubby *Eucalyptus pulchella/globulus* forest. Very dense understorey, *Dodonea viscosa* dominant with *Bursaria spinosa.* Grass layer is dense, with large tussocks of *Lomandra longifolia.* Thick layer of leaf litter.	70%
North Hobart - View from Domain c 1910s (app. 1, pl. 15)	1910	West	Tree layer consists of sparse, juvenile *E. globulus.* Understorey grass-dominant with various species of native grasses	10%	Shrubby *Eucalyptus globulus* forest, very dense understorey with *Dodonea viscosa* dominant as well as *Acacia dealbata, Acacia mearnsii, Allocasuarina verticillata, Bursaria spinosa, Exocarpos cupressiformis.* Lower strata consisting of range of native grasses including *Lomandra longifolia., Poa,* etc. Lots of leaf litter, fallen branches, etc.	70%
View of the Eastern Shore from the Domain Road (app. 1, pl. 17)	1920	East	Canopy layer eucalypt-dominate, understorey of younger eucalypts and *Bursaria.* Understorey open, grass layer not seen	40%	*Allocasuarina verticillata* forest with scattered eucalypts, *Bursaria spinosa* also present in understorey.	70%

would become bare (apps 2.7, 2.8). Between 1810 and 1850, landscape paintings show most of the Domain as being wooded across the hill, although the density of tree cover varies somewhat with artistic interpretation. Clearing was concentrated in the southern section, particularly near the shoreline, as indicated by images taken from within the Domain. The southern section of the Domain is depicted as an open grassy woodland with tall eucalypts with few or no understorey shrubs in images from the early decades after colonisation, such as T.E. Chapman's *In Paddock* (1836) and *Taken in the Paddock, Hobart Town, V.D.L.* (1837, pl. 4) (apps 3.16, 3.17).

The openness of the understorey of this lowland area of the Domain is likely to have been similar to its pre-colonial state, as this area would probably have been favoured by the muwinina people for hunting (Kirkpatrick 2004); however, indicators of European modification such as stumps (Ryan 2009) are present in many images from this time.

PLATE 2 — *View of Sullivan's Cove.* Inscribed by Lt. John Bowen, although variously attributed to George William Evans and G.P. Harris, 1804. Trees in right-side foreground are on the southwestern shoreline of the Domain. Digitised item from the State Library of New South Wales, https://search.sl.nsw.gov.au/permalink/f/1cvjue2/ADLIB110326130

PLATE 3 — *Hobart Town ca. 1805*, G.P. Harris, 1805. The southern shoreline of the Domain can be seen on the far-right side, inscribed with the number 10. Digitised item from National Library of Australia, http://nla.gov.au/nla.obj-135224422

Stock grazing replaced burning and grazing by marsupials as the major disturbance controlling the understorey, keeping down the length of the grass and impeding shrub and tree establishment. Cattle grazing was banned along with tree removal in 1816 (app. 2.6). However, stock and stockkeepers continued to "trespass" onto the Domain for decades, resulting in the Domain being fenced and constables being stationed for the purpose of impounding stock (apps 2.9, 2.10). In the 1820s, illegal grazing was so rampant that accusations were made that the Domain fence was intentionally kept in a state of disrepair so that profit could be made from impounding the trespassing stock (app. 2.11). The issuing of grazing licenses in the 1840s (app. 2.12) did not appear to have any impact on reducing stock numbers, with the Domain described as being "overrun with wild bullocks and flocks of sheep" (app. 2.13).

1850s–1900

Grazing appeared to occur throughout the Domain. *Hobart Town from the Domain* by Knud Bull (app. 3.26) depicts a shepherd and a flock of sheep at the northern end of the Domain, while *View of Rossbank Observatory,* 1854 (app. 3.27), by the same artist, shows a similar scene near the southern shoreline of the Domain. These clearly indicate the differences in vegetation between these two sections of the Domain in this period. The vegetation in the first image appears dense, forest-like, and "well-wooded", while in the second image, the area is open and grassy, with stumps and logs indicative of tree clearance (Ryan 2009). Newspapers at this time refer to both the threat to humans and the impact on young trees occurring as a result of the high stock levels on the Domain (apps 2.14, 2.15).

PLATE 4 — *Taken in the Paddock, Hobart Town, V.D.L.* 1837, T.E. Chapman. No longer available online. Stump can be seen in the right foreground.

PLATE 5 — *River Derwent, from the Queen's Domain, Hobart,* Elite Studio, 1884. A similar view of the Derwent River can be seen in plate 4. Digitised item from Allport Library and Museum of Fine Arts, Tasmanian Archive and Heritage Office, https://stors.tas.gov.au/ILS/SD_ILS-634418

By the mid- to late-nineteenth century, there are abundant references to the decline of the vegetation on the Domain. Charles E. Walch, well-known bookseller, preacher, and future Chairman of the Queens Domain Committee, wrote a lengthy Letter to the Editor in 1874 decrying the "half a century of utter neglect" and the "[defacing of] its natural beauties" to clear land for the various buildings, quarries, slaughter-yards, and fences on the Domain, as well as for the "extensive" grounds of Government House (app. 2.3). Over a period of years Walch observed the loss of trees across the Domain "partly from rapid natural decay, and partly by man's destroying hand", noting that the western slope of the Domain in particular was "quite bare, while many of the trees still standing are in the last stages of decay" (app. 2.3). Another source noted that the western slope of the Domain, known to be well-wooded in the 1850s, was almost bare by the 1860s due to the regular system of depredation of illegal tree removal that occurred due to the lack of police supervision (app. 2.8).

The Superintendent of the Royal Society Gardens, Francis Abbott, in a paper read to the Royal Society of Tasmania in 1875, spoke of the need for the "improvement" of the Domain, and drew attention to the causes for the "stunted appearance" of the trees on the Domain:

> *In the first place, there can be no doubt that between 20 and 30 years ago, many of the largest gum trees were cut down [...] during the whole of this time the surface has been depastured by sheep and cattle, which has had the combined effect of consolidating the surface, and preventing any seedling trees from springing up to supply the place of those removed. The wattles again present a most unsightly and stunted appearance, and [...] are evidently hastening to decay [...] partly due to the cause just mentioned, and partly to the fact that the lower branches have generally been browsed off when the trees were young. Again, the depasturing of cattle has not only consolidated the surface, but it has kept the grass close grazed, which may be considered as removing nature's mulching, the effect of which is that the rains, instead of soaking into the ground, rush precipitately to the water-courses [...] and what little does enter the soil is quickly dried up by the sun and wind.* (Abbott 1875, p. 33)

Former Surveyor-General J.E. Calder described the "many unsightly trees that disfigure the surface [...] and give one the very poorest idea of Tasmania's forest lands" (app. 2.16). Notably, Calder asserts that the Domain, previously being "ancient forest [...] in vigorous growth" began to decline after the "slaughter of the forest trees" was permitted to form what would become the Royal Society Gardens, as well as the ending of police patrols of the Domain's borders for stock impounding (app. 2.16).

It is evident from these descriptions that the Domain was suffering from both a decline in the quantity of trees and in the health of the remaining trees; however, most of the decline was concentrated in the Domain's southern area. Abbott notes that the "upper portions" of the Domain have "sufficient" "natural arboreal vegetation", consisting of *E. viminalis* and *E. amygdalina*, as well as several trees of "blue gum, native cherry, she-oak, native box, and banksia" (Abbott 1882). This is one of the very few references to understorey vegetation on the Domain, other than to the "twisted" wattles growing on the eastern shore near Government House (app. 2.17) and reports of *Acacia mearnsii* springing up after fires (app. 2.18). Photographs from this time demonstrate the sparse distribution of eucalypts and lack of understorey (pl. 5).

Mounting public pressure resulted in management changes on the Domain. Cattle grazing was banned in 1881, although sheep grazing was permitted to continue (app. 2.19). This was praised as a "step in the right direction", although concerns were raised that sheep would be insufficient for managing the length of the grass (Crouch 1881). The 1890s saw the formalisation of the Queens Domain Committee, whose notable works in this period include the intentional thinning of the Domain's remaining eucalypts, to maintain a "park-like" appearance (app. 2.20), the planting of the pinetum near the Botanical Gardens, where a "few standing gum trees" would be allowed to remain (app. 2.21), the lopping of over a hundred unhealthy eucalypts (app. 2.18), the levelling and replanting of the quarry opposite Government House (app. 2.22), the planting of (non-native) eucalypts on the eastern slope of the Domain between Government House and Cornelian Bay (app. 2.23) and the development or expansion of roads (apps 2.24, 2.25, 2.26).

1900s–1950s

Two decades of cattle exclusion had caused the grasses on the Domain to become a fire hazard; in 1905, the Queens Domain Committee debated the benefits of the reintroduction of cattle on fuel loads versus the potential damage to the new plantations that dotted the Domain (app. 2.27). Cattle would eventually be reintroduced on an ad-hoc basis to control the grass, although they quickly became abundant, roving in droves of "up to 20" and causing damage to young trees planted along the roads (apps 2.28, 2.29). Dry weather and lack of water in the early 1910s caused the death of several plantings, and accidental fires had caused "grave losses" to young trees, while "larger gums have become so weakened by fires around their roots that it now becomes imperative an earnest effort made to re-clothe at once the more frequented parts of the Domain with young eucalypts" (app. 2.29). Planned burns were undertaken to remove the grass fuel load and protect the plantations from further damage from bushfires (app. 2.28).

PLATE 6 — *Photograph - Hobart - Domain - Soldiers Memorial - tree plantations,* 1914–1918. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/NS869-1-48J2K$init=NS869-1-48

In 1917, funding concerns, as well as a lack of participation from committee members, prompted the Queens Domain Committee to recommend management of the Domain be taken over by the Hobart City Council, which subsequently happened (app. 2.30). This change in management led to a "speedy improvement" in the Domain's "park-like aspect" (app. 2.31).

One of the major planting regimes in the early twentieth century was the Soldiers Avenue, a double-lined avenue of *Cedrus deodara* extending from the southern to the northern section of the Domain Hill established after the First World War (app. 2.32, pl. 6). The scattered distribution and poor condition of *E. viminalis* on the southern slope of the Domain surrounding the juvenile *Cedrus* behind protective guards can be seen in plate 6. Many of the introduced trees, being unsuited to the soils of the Domain, died shortly after being planted (app. 2.33) and work was required to improve the view of the avenue (app. 2.34).

Beginning in 1920 and continuing until the mid-twentieth century there was an organised effort to "reclothe" many of the bare areas of the Domain with native trees (apps 2.35, 2.36) with most of these plantings occurring on the western slope of the Domain from behind the Hobart High School grounds to the northwestern section (apps 2.37, 2.38). The eastern section of the Domain was said to be "well clothed with indigenous trees" but on the shallower soils of the western slope, "trees were not so abundant and healthy" and were therefore in need of restoration (app. 2.39).

Over a thousand trees, including Australian natives such as *A. mearnsii, A. verticillata, E. globulus* and *A. pycnantha* (not native to Tasmania) as well as exotics including ashes, silver birches and conifers (apps 2.40, 41) were planted in this section of the Domain over the decades, as well as around the cricket ground (app. 2.36) and the former zoo site (app. 2.42). Wattles were planted yearly as a part of the Tasmanian Wattle League's annual Wattle Day events (app. 2.41).

Many mature trees, said to be either dead or suffering from dry rot, were removed from the northwestern section of the Domain in the early 1930s, with many of the trees remaining being lopped (app. 2.43). This area was described as a "forest of gaunt skeletons" (app. 2.44) after the removal, but a year later it was described as "refreshingly green" due to the "rejuvenation" of the trees as a result of pruning (app. 2.45).

The sanctioned removal of trees, the illegal removal of trees by vandals and the "withering away" of many of the juvenile trees (app. 2.46) resulted in parts of the western section of the Domain being described as "denuded" and "flea bitten" (app. 2.47). One Letter to the Editor attributed the continued poor state of the Domain's vegetation to the fact that "[owing] to the destruction of the original forests [...] the Domain is no longer an ideal environment for eucalypts" (app. 2.48). The lack of an understorey to provide nutrients, combined with the constant assault on the vegetation from strong winds, and the "poor, stony soil" meant that no tree planted could be expected to survive "more than a few years" (app. 2.48). Still, the replanting

of bare patches with native vegetation continued until the 1950s on the western section of the Domain as well as on the apex of the hill (app. 2.49).

The grazing of cattle ceased indefinitely in the 1920s, and the extreme length and dryness of the grass led to an increase in grass fires on the Domain (apps 2.50, 2.51, Kirkpatrick 2004). There are numerous references to fires on the Domain throughout the twentieth century, some being small and easily contained, some burning up to 20 acres of grass and causing significant damage to trees (app. 2.53). Major fires occurred in 1952 on both the western and eastern sides of the Domain where more than 15 acres of grass was burned (apps 2.53, 2.54) and again in 1953 when 91 fires burned in Hobart within a period of three weeks, most of these occurring on the Domain (app. 2.55). The destructiveness of this fire season led to half of the grass area of the Domain being burned off (app. 2.56) and the introduction of mowing and cutting to control the grass (app. 2.56).

DISCUSSION

The results from the comparison of historic images with the modern vegetation indicate an increase in tree cover, which is in line with the pattern of woody thickening observed on the Domain since 1974 (Kirkpatrick 2004). The major change to disturbance regimes on the Domain after colonisation was the replacement of Aboriginal fire regimes with high-intensity stock grazing. This was extremely common in grasslands and grassy woodlands post-colonisation (Fensham 1989, Lunt 1998b, Franco & Morgan 2007). The encroachment of shrubs into grasslands and grassy woodlands after the removal of grazing as a disturbance regime is also common (Lunt 2002). The encroachment of *A. verticillata* into eucalypt forest and woodland observed by Kirkpatrick (2004) probably began after the severe fire seasons of the early 1950s, as the transition from eucalypt grassland to *Allocasuarina* forest occurs in the absence of disturbance or after low-level fires (Lunt 1998a, Lunt 1998b). The grassy woodland structure of the Domain was maintained by the introduction of grazing after the removal of Aboriginal fire regimes; however, the increase in stock levels with the introduction of grazing licenses, in conjunction with the removal of trees for land clearance, firewood, shipbuilding and other purposes, was suggested to have resulted in soil compaction, exposure to increased wind, soil drying, and soil water repellence which contributed to tree dieback (Bailey 2012). High grazing levels would have also contributed to the lack of recruitment of eucalypt seedlings, both for natural regeneration and those planted by the Queens Domain Committee in the late nineteenth century (Lunt 1991, Zacharek 1997). Grazing also probably impeded the growth of *A. verticillata* seedlings. Given the current abundance of this species on the Domain (Kirkpatrick 2004), it is notable that there are relatively few mentions of *A. verticillata* in the historic record. Abbott (1882) states that there were "a few trees" of *A. verticillata* in the northern section of the Domain, which is logical considering the comparative lack of disturbance that occurred in this area. "She-oaks" were also amongst the species planted in the early twentieth century on the western slopes of the Domain. Low-intensity sheep grazing was found to reduce the regeneration of *A. verticillata* seedlings on Kangaroo Island (Pepper 1997). It is likely that the reduced grazing pressure following the removal of cattle from the Domain in 1881, provided sufficient disturbance to prevent the establishment of *A. verticillata* in much of the Domain until the 1950s. Some species on the Domain, such as *T. triandra*, may also have benefited from the cessation of grazing (Kirkpatrick 1986, Zacharek 1997). Grasses were noted to increase in abundance following the removal of cattle, although no species was specified. It is evident that the exclusion of cattle and the increase in fuel loads, in combination with warm and dry weather in the early twentieth century, resulted in increased fire frequency (Leonard *et al.* 2010).

In a long-term study of vegetation dynamics in a coastal grassy woodland, with similar patterns of disturbance regimes change to the Domain, Lunt (1998a) observed that the two phases of European management were marked by a lack of understanding of the impact of the previous management decisions on the present vegetation. This was not the case in the second phase of European land management on the Domain. The members of the Queens Domain Committee, many of whom were members of the Royal Society possessing extensive botanical knowledge, were well aware of the causes of the decline in vegetation on the Domain, as evidenced by the letters read by Abbott in 1875 and 1882. However, this understanding did not appear to have a corresponding influence on the success of "improvement" works on the Domain. Many of the Committee's strategies were informed by colonial ideals that valued an English park-like landscape and European deciduous species (Lum 2018) over the "rugged wilderness" of the Tasmanian bush (*Hobart Town Daily Mercury* 22 May 1860, p. 2, app. 2.57). This perspective needs to be considered when analysing historical descriptions of the Domain, particularly the use of terms such as "improvement", a word rooted in the philosophy espoused by *Lancelot* "Capability" Brown and other nineteenth-century European landscape architects (Lum 2018).

Limitations

Landscape paintings have considerable value for establishing the vegetation structure and composition of historic landscapes (Ryan 2009): however, considering the subjectivity of landscape paintings is essential when using them as sources for reconstruction (Fensham 1989, Farag-Miller *et al.* 2013). Australian landscape artists were often not concerned with creating an accurate representation of vegetation, but more with conveying an image of the Australian landscape that would be appealing to prospective settlers (Romanin *et al.* 2016). Images of the Tasmanian landscape painted by John Glover, for example, were captivating to an English audience due to their ability to convey the exotic vegetation while at once evoking the atmosphere of an English park (Lum 2018). Ryan (2009) notes the accuracy of early colonial

artists in depicting vegetation structure. It is possible to identify eucalypts, tussocks, and understorey shrubs in many paintings of the Domain even if the artwork is stylised. Due to the quantity of images depicting the Domain, it was also possible to cross-reference several of the landscape paintings from the mid-nineteenth century with photographs from the same era to establish accuracy.

Written historical material can be used to support the image record (Ryan 2009). Some assumptions must be made however when assessing the language used by early colonial writers to describe vegetation. Early colonial surveyors described the grassland and grassy woodland vegetation of the Midlands as "thinly timbered", "moderately wooded" and "interspersed with wood" (Fensham 1989), while the Domain was described as "well-wooded" without thick timber. Lunt (1998a) notes the subjectivity of terms such as "thickly timbered", noting that they can only be interpreted in comparison with the surrounding landscape. "Well-wooded" could be interpreted to mean densely wooded (although Fensham (1989) notes that "forested" would be the more commonly used phrase), or that the wood itself was in good condition. While objective records such as surveyors' field notes and maps are often used for historic reconstruction (Bickford & Mackey 2004), there are few of these sources available for the Domain. As the Domain has been an important place for the people of Hobart since before colonisation, it has the benefit of a wealth of informal historical records relating to its land use, particularly in the newspaper record. While this record is invaluable in reconstructing the patterns of land use, it is also essential to acknowledge the subjectivity of opinion. For example, one article from the *Mercury* in 1883 dismisses improvement works on the Domain by saying that only "here and there a chair erected, and a tree planted and guarded, give evidence they are doing something", while another from the *Daily Telegraph* in the same year commends the "highly successful" management for "here and there" planting shrubs and constructing "convenient and substantial seats" (app. 2.58, 2.59). Despite these limitations, the present study has benefited from the abundance of references and the descriptive language about the vegetation that would not necessarily be found in surveyors' journals. Phrases such as the "slaughter of forest trees" and "forest[s] of gaunt skeletons" demonstrate both the severity with which the Domain was perceived to be in decline, as well as how much the people of Hobart cared about the state of the "people's park" (Cahalan 2016).

CONCLUSION

This study has documented the changes to disturbance regimes that have occurred in the Queens Domain following the British invasion and European settlement. The Domain has had periods of high and low tree cover caused by the introduction and exclusion of disturbances. Indigenous fire regimes and grazing from native herbivores were replaced by grazing from cattle maintaining the open grassy woodland structure of the Domain, but also impeding the growth of new trees. Tree removal and land clearing resulted in the reduction of tree cover on the Domain. The cessation of these processes has contributed to the woody thickening of the Domain that has occurred since the mid-twentieth century.

ACKNOWLEDGEMENTS

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APPENDIX 1: COMPARISON IMAGES

PLATE 7 — *View from the Domain looking N.W across New Town Bay, Bellevue in foreground,* George Thomas William Blamey, 1826–1853. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/144582954

PLATE 8 — Location of *View from the Domain looking N.W across New Town Bay, Bellevue in foreground* rephotographed in 2020.

PLATE 9 — *Government House, Hobart Town, and the River Derwent from the Domain* 1866, Samuel Gill. Digitised item from Libraries Tasmania, http://nla.gov.au/nla.obj-135682499

PLATE 10 — Location of *Government House, Hobart Town, and the River Derwent from the Domain* rephotographed in 2020.

PLATE 11 — *Cornelian Bay, Hobart* 1890, A. Mather & Co. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AUTAS0016125396028$init=AUTAS001612539602

PLATE 12 — Location of *Cornelian Bay, Hobart* rephotographed in 2020.

PLATE 13 — *View of Hobart from the Domain showing Campbell Street and the Park Street intersection* 1900, photographer unknown. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH30-1-9578

PLATE 14 — Location of *View of Hobart from the Domain showing Campbell Street and the Park Street intersection* rephotographed 2020.

PLATE 15 — *North Hobart – View from Domain* 1910, James Chandler. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/NS869-1-440

PLATE 16 – Location of *North Hobart – View from Domain* rephotographed 2020.

PLATE 17 — *View of the Eastern Shore from the Domain Road* 1920, T. Crawford. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/NS1013-1-515

PLATE 18 — *View of the Eastern Shore from the Domain Road* rephotographed 2020.

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APPENDIX 3: IMAGE REFERENCES
(accessed 14 October 2020 unless otherwise specified)

Hobart Town ca. 1805, G.P. Harris. Digitised item from National Library of Australia, http://nla.gov.au/nla.obj-135224422

Sketch of Hobart Town 1817, Lt. C. Jeffreys. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH30-1-2653

Hobart Town, Van Dieman's Land from Mount Nelson 1820, Joseph Lycett. Digitised item from Libraries Tasmania, http://nla.gov.au/nla.obj-134642888

South West View of Hobart Town, Van Diemen's Land 1820, George William Evans. Digitised item from State Library of New South Wales, http://digital.sl.nsw.gov.au/delivery/DeliveryManagerServlet?embedded=true&toolbar=false&dps_pid=IE3238855&_ga=2.14471039.978739024.1602748466-1941299773.1597127201

Hobart Town, Van Dieman's Land 1820, Joseph Lycett. https://stors.tas.gov.au/144585098

Copy of Drawing *'Hobart Town Looking South West from Domain'* 1822, J.W. Beattie. Digitised item from National Library of Australia, https://stors.tas.gov.au/AI/NS2511-1-308

North east view of Hobart Town, Van Dieman's Land 1823, Joseph Lycett. Digitised item from National Library of Australia, https://stors.tas.gov.au/ILS/SD_ILS-700846

View of Hobart from the Top of Mt Nelson with Hobart Town in the Distance 1825, Joseph Lycett. Digitised item from State Library Victoria, http://handle.slv.vic.gov.au/10381/129734

Hobart from a sketch 1827, E.R. Pretyman collection. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/NS1013-1-1547

Hobart Town, Van Diemen's Land 1828, G.W. Evans/R.G. Reeve. Digitised item from National Libraries of Tasmania, http://nla.gov.au/nla.obj-135297750

Panorama of Hobart 1828, Augustus Earle. Digitised item from State Library of New South Wales, https://search.sl.nsw.gov.au/permalink/f/1cvjue2/ADLIB110328958

Painting of Hobart from Upper Murray Street 1830, J.W. Beattie collection. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/PH30-1-629J2K$init=PH30-1-629

Beattie sketch of Hobart from Battery Point 1830, J.W. Beattie collection. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH30-1-630

Hobart town, taken from the garden where I lived 1832, John Glover. Digitised item from State Library of New South Wales, https://search.sl.nsw.gov.au/permalink/f/1cvjue2/ADLIB110314722

Hobart Town as seen from the top of Mount Nelson 1836, Benjamin Duterrau. Digitised item from National Library of Australia, http://nla.gov.au/nla.obj-135290119

In Paddock, Hobarton, V.D.L. 1836, T.E. Chapman. No longer available online.

Taken in the Paddock, Hobart Town, V.D.L. 1837, T.E. Chapman. No longer available online.

Rade D'Hobart Town (Ile Van-Diemen) dessine par le Breton 1841, Eugene Circeri. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/ILS/SD_ILS-174369

Hobart Town &c. from Mount Nelson 1844, J.S. Prout. Digitised item from National Gallery of Victoria, https://www.ngv.vic.gov.au/explore/collection/work/28582/

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Hobart Town from the Domain 1844, James William Mansfield. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/ILS/SD_ILS-606597

HMS Anson (Female Convict Hulk), Off Queens Domain 1844–1850. Unknown artist. No longer available online.

Hobart Town and the Derwent River, Van Diemens Land, from a sketch by Capt. Hext, 4th, The Kings Own Regiment 1845, Charles Hutchins. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/ILS/SD_ILS-97377

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View of Rossbank Observatory 1854, Knud Bull. Digitised item from State Library of New South Wales, http://digital.sl.nsw.gov.au/delivery/DeliveryManagerServlet?embedded=true&toolbar=false&dps_pid=IE9193740&_ga=2.106792011.978739024.1602748466-1941299773.1597127201

Hobart Town from the Domain 1854–1956, Knud Bull. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/144584778

View of Part of Hobart Town from the windmill 1855, J.B. Henderson. Digitised item from National Library of Australia, http://nla.gov.au/nla.obj-135174519

Government House, Hobart from railway track 1859, no author. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/LPIC147-3-154

Government House, Hobart 1859, J Walch. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/LPIC147-3-174

Government House looking southeast 1860–1870, Morton Allport library. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/ILS/SD_ILS-629778

Patent Slip, Queens Domain 1865, W.L. Crowther library. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/ILS/SD_ILS-158083

Government House, Hobart Town, and the River Derwent from the Domain 1866, Samuel Gill. Digitised item from Libraries Tasmania, http://nla.gov.au/nla.obj-135682499

Government House, Hobartown, Tasmania, Monday 22 June 1868, Stanley Leighton. Digitised item from National Library of Australia, http://nla.gov.au/nla.obj-138907943

Regatta at Hobart Town, Tasmania, in honour of the visit of 'H.R.H' Duke of Edinburgh, and *Hobart Town, the Capital of Tasmania* 1868, Illustrated London News. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/ILS/SD_ILS-735049

Government House, Hobarton, Tasmania 1869, George Penkivil Slade. Digitised item from National Library of Australia, http://nla.gov.au/nla.obj-138988325

The Derwent Near Government House 1870, unknown artist. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH1-1-25

Hobart Town 1879, A.C. Cooke. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/ILS/SD_ILS-94421

Domain Slip, showing shoreline looking south 1880, unknown artist. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH30-1-883

View of the Domain taken from jetty looking towards Government House 1880, unknown artist. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH30-1-2991

View of the Hobart Domain showing trees, Government House and shipyards 1880, unknown artist. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH30-1-3655

Appendix 3 cont.

Domain slipyard, Hobart 1884, unknown artist. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH30-1-6862

River Derwent, from the Queen's Domain, Hobart 1884, Morton Allport library. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/ILS/SD_ILS-634418

Whaling brig 'Velocity' on Domain Slips 1890, unknown artist. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH30-1-5709

View from Beauty Bay to Beltana Point - Hobart Domain in Background 1890, unknown artist. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH30-1-6854

Cornelian Bay, Hobart 1890, A. Mather & Co. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AUTAS00161 25396028$init=AUTAS001612539602

Cornelian Bay, Hobart 1890, H.H. Baily. Digitised item from National Library of Australia, https://stors.tas.gov.au/AI/PH30-1-7552

View of Cornelian Bay showing beach, cemetery and parts of Risdon (the present location of the Electrolytic Zinc Works) 1910, H.H.Baily. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH30-1-2643

A view of Hobart, Domain and Eastern shore taken from West Hobart 1900, E.R. Pretyman collection. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/NS1013-1-729

Panoramic view from North Hobart showing Holy Trinity, Elizabeth Street, Patrick Street, the Domain, within the view are the exhibition buildings 1895, unknown artist. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH30-1-2061

View of Hobart wharves, taken from the Domain 1895, unknown artist. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH30-1-1475

View of Government House, Hobart from the Domain 1900, unknown artist. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH30-1-97

Hobart from the Domain, above Campbell Street showing Holy Trinity and burial ground 1900, E.R. Pretyman Collection. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/NS1013-1-768

View of Hobart from the Domain showing Campbell Street and the Park Street intersection 1900, unknown artist. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH30-1-9578

View overlooking the intersection of Elizabeth and Warwick Streets, showing Holy Trinity, Burial Ground and view of Domain and River Derwent 1900, unknown artist. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/PH30-1-2514J2K$init=PH30-1-2514

Letitia and Park St from the Domain - looking North West up to Mt Stuart and North Hobart 1900, Cecil Percy Ray. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/NS392-1-737

Hobart - Domain - Government House in Distance 1900, O'May Family. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/NS2511-1-360

Glass lantern slide - Hobart - Domain - Lower Domain Road 1900, unknown artist. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH40-1-1845

Gunners Quoin from the Domain 1901, unknown artist. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH30-1-9434

Coloured postcard view of Government House, on the Hobart Domain – Government House and Derwent River, on the Hobart Domain 1905, unknown artist. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH30-1-2752

New Town from Domain 1910, J.W. Beattie. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/NS4077-1-248

North Hobart - View from Domain 1910, James Chandler. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/NS869-1-440

Hobart - Domain - Soldiers Memorial - tree plantations 1918, James Chandler. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/NS869-1-48

View of the Eastern Shore from the Domain Road 1920, T. Crawford. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/NS1013-1-515

Aerial view of buildings and a warship at a distance on the River Derwent during the Royal tour by Edward, Prince of Wales, Hobart, Tasmania 1920, H. Baily. Digitised item from National Library of Australia, http://nla.gov.au/nla.obj-909612670

Government House, Hobart 1922, Herbert John King. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/NS5748-1-94

Government House, Hobart (2) 1922, Herbert John King. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/NS5748-1-38

Aerial view of Hobart from a Matthews Aviation amphibious aeroplane, Tasmania 1930, George Matthews. Digitised item from National Library of Australia, http://nla.gov.au/nla.obj-151696129

Hobart – Electrolytic Zinc Company and view towards Cornelian Bay 1930, J.J.N. Barnett. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/NS3305-1-8

Hobart aerial view taken with an E9 camera 1946, Peter Volkert Payens. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/NS1714-1-38

Hobart, aerial view, River Derwent 1955, unknown artist. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/AB713-1-5003

Aerial view of River Derwent 1960, Southern Metropolitan Master Planning Authority. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/AA116-1-130

Aerial view of the Northern Suburbs and Hobart 1962, unknown artists. Digitised item from Libraries Tasmania, https://stors.tas.gov.au/AI/PH30-1-3488

Aerial photograph 1969, J. Kirkpatrick, private collection.

Aerial photograph 1996, J. Kirkpatrick, private collection.

S. WARREN CAREY: NEW GUINEA OIL EXPLORER (1934–1942)

by Peter Baillie

(with one text-figure, eight plates and one table)

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Samuel Warren Carey (1911–2002), Professor of Geology at the University of Tasmania from 1946 until 1976, was recognised internationally as a controversial extrovert in global tectonics. He joined Oil Search Ltd, and then the Australasian Petroleum Company working as a field geologist in New Guinea from 1934 until 1942. Carey and his colleagues carried out a heroic campaign of geology-based field exploration under the most difficult of conditions. Although their work did not find commercial hydrocarbons it paved the way for PNG's current hydrocarbon industry. While his post-World War Two work is well documented through his publications and the reminiscences of those who worked with and were taught by him, his pioneering work as an explorer in the inhospitable environment of New Guinea before he took up his post in Tasmania is less well known and the subject of this paper.

Key Words: S. Warren Carey, pre-WW2, geology, exploration, New Guinea, Oil Search Ltd, Australasian Petroleum Company.

INTRODUCTION

S. Warren Carey (1911–2002), Professor of Geology at the University of Tasmania from 1946 until his retirement in 1976, was internationally acknowledged as a controversial extrovert in global tectonics who vigorously expounded and defended his belief in Earth expansion (Quilty & Banks 2003).

An early believer of continental drift, many of his ideas were developed and matured as a result of fieldwork carried out in the (then) Territory of New Guinea and the Mandated Territory of Papua in the decade preceding World War Two (WW2). He was a geologist with Oil Search Ltd from 1934 to 1938 and subsequently a senior geologist with the Australian Petroleum Company (APC) from 1938 until the intervention of war in 1942. A photo of Carey, taken in New Guinea around 1936 is shown in plate 1.

While his post-WW2 work is well documented through his publications and the reminiscences of those who worked with and were taught by him, his pioneering work as an explorer in the inhospitable environment of New Guinea is less well known. The purpose of this paper is to detail Carey's New Guinea work to better understand both its influence on his own thinking and in the context of New Guinea geology.

Many of the pre-WW2 geographic names used by Carey and his colleagues are no longer in use and their modern names have been adopted in this paper. The Imperial system of measures is sometimes retained as it was the system in use at the times under discussion.

NEW GUINEA PERSPECTIVE

The geography of the large bird-shaped island of New Guinea (see fig. 1) is diverse and dominated by rugged mountains, rainforests and river systems. A spine of mountains, the New Guinea Highlands, runs the length of the island, rises to over 4000 m with glaciers present in the highest areas (Lorenz National Park in the Indonesian Province of West Papua). Since the seventeenth century, the western part of the island had been part of the Dutch East Indies while after World War One (WW1) the eastern part comprised the northern

PLATE 1 – S.W. Carey about 25 years of age; New Guinea, circa 1936. The photo, without attribution, is from Carey's 1936 thesis. The identification was confirmed by his daughter Robyn to the late Max Banks.

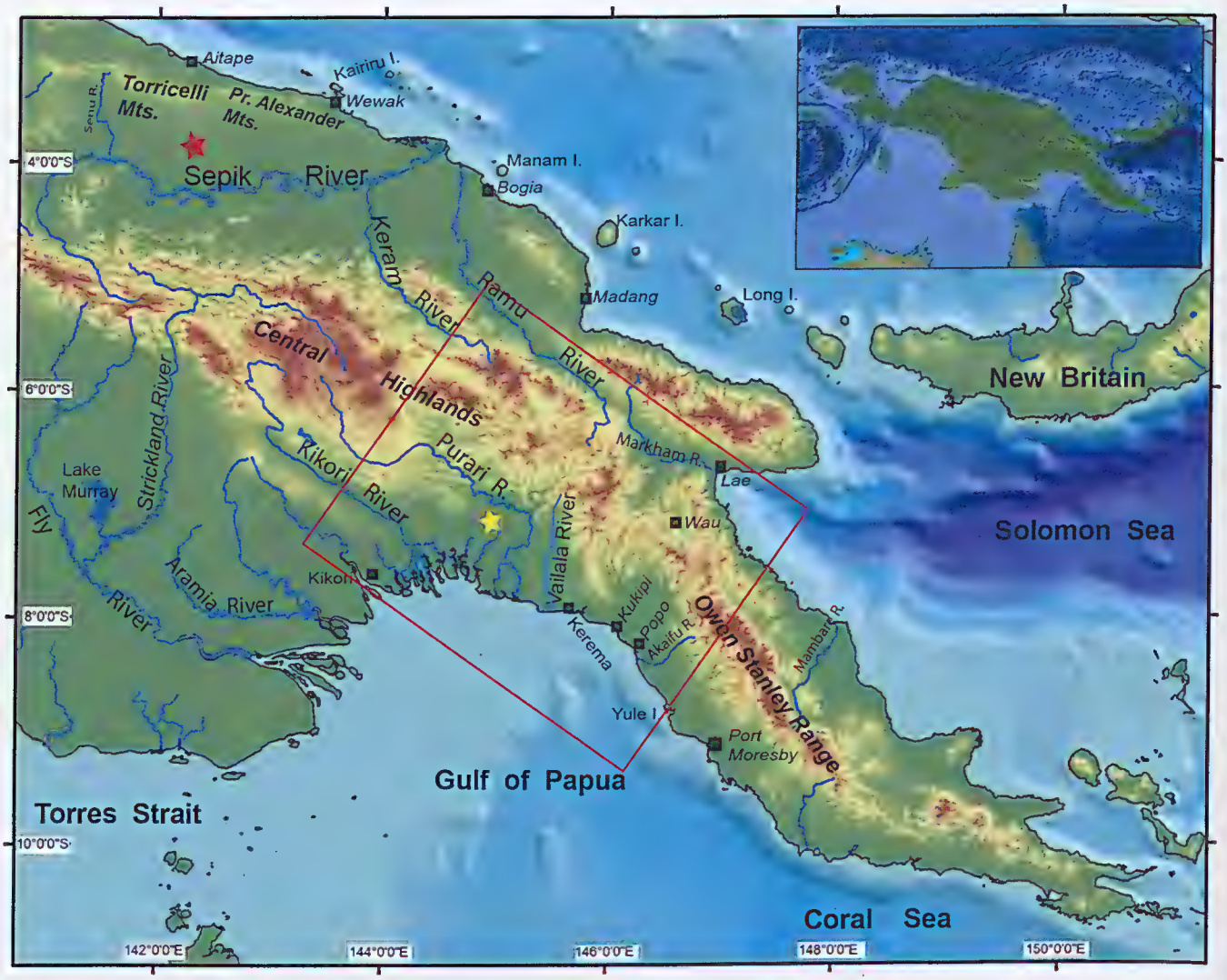

FIGURE 1 – Locality map of eastern New Guinea; red star near Sepik River approximate position of the Maimai Dome; yellow star south of Puari River approximate position of the Puri Anticline. Approximate position of Plate 7 indicated by red rectangle. Inset from Google Earth showing whole island of New Guinea.

Mandated Territory of New Guinea (prior to WW1 a German colony; mandated to the British Government, on behalf of Australia, by the League of Nations in 1920) and the Territory of Papua (ceded from the British to Australia in 1906 (plate 2). The territories were united in 1949 becoming self-governing in 1975 as the sovereign nation of Papua New Guinea (PNG).

Although all the climatic regions of New Guinea are basically tropical, climate is variable. In general, eastern New Guinea has a wet, warm-to-hot humid climate with two seasons governed by prevailing wind direction:

- a drier season from May to October with northwesterly winds
- a wet season from November to April when over five metres of rain might fall.

All early exploration was hampered by the mountainous terrain, dense (often impenetrable) vegetation and rugged topography (broad valleys bounded by steep jungle-clad mountains characterise the Central, Western and some of the Southern Highlands). Early surveys were conducted in areas that were unexplored, unmapped and populated by people who had never been in contact with the outside world and were often at war with their neighbours (e.g., Wade 1927, Rickwood 1990, 1992). Survey parties faced problems caused by isolation, the prevalence of tropical diseases such as malaria, dysentery and scrub typhus (quinine was the only treatment for malaria and there was virtually no cure for dysentery or scrub typhus), the hostile climate with its annual periods of high rainfall (and consequent high flow in the rivers), thunderstorms and cyclones, and the discomforts due to a bewildering assortment of insects, leeches and other unpleasant creatures. Persons who undertook such work required exceptional physical and mental qualities.

EXPLORATION SUMMARY TO WW2

Little effort was made to understand the geology of New Guinea until the end of the nineteenth century – unsurprising given the logistical difficulties. Joseph Beete Jukes (after whom Mt Jukes in the West Coast Range of Tasmania is named), naturalist and geologist on the surveying expeditions to New Guinea of HMS *Fly* said:

> *I know of no part of the world, the exploration of which is so flattering to the imagination, so likely to be*

PLATE 2 – 1924 Map by E.R. Stanley of Eastern New Guinea showing post-WW1 district boundaries; Mandated Territory of New Guinea (green), Territory of Papua (pink), Dutch New Guinea (now Indonesia) (yellow); accessed from https://nla.gov.au/nla.obj-1992750272/view. Territories of New Guinea and Papua now the sovereign nation of Papua New Guinea (PNG).

> *fruitful in interesting results, whether to the naturalist, the ethnologist, or the geographer, and altogether so well calculated to gratify the enlightened curiosity of an adventurous explorer, as the interior of New Guinea.* (Jukes 1847, vol. 1 p. 291)

Limited geological and palaeontological work was carried out in German New Guinea prior to WW1. In Papua, the first recorded geological observations were made around Port Moresby by Sir William MacGregor in 1893 who ascended the Purari River (fig. 1) by launch, collected some Cretaceous belemnites and noted the occurrence of coal which subsequently became the target for limited exploration (Carey 1941).

Oil exploration commenced in 1911 when gold prospectors reported an oil seep ('kerosene on a small creek') in the Vailala River (fig. 1). Local inhabitants of the district had long known of the small mud volcanoes and bubbling pools, but since they regarded them as being due to the agencies of evil spirits, they not only avoided the localities but were loath to give any information concerning them (Wade 1927, Pratt 2000).

Evan R. Stanley was appointed the first Government Geologist for Papua in April 1912 and visited gas seepages near the Purari River (fig. 1) in May 1912. He commenced systematic surveys of the interior, examined many parts of the country east of the Purari River, produced a sketch map in 1913 at one inch to the mile (1:63,360) showing the location of many seeps he had visited, and published the first geological map of Papua in 1924 (Rickwood 1990, https://nla.gov.au/nla.obj-2057713415/view).

Exploration (including drilling and geological mapping) in Papua prior to WW1 was carried out by the Australian Commonwealth Government under the direction of Dr Arthur Wade. In 1918 a limited agreement was made with the British Government to share the expenses of further work, and the Anglo-Persian Company (which eventually became British Petroleum BP) was put in control of the combined effort, the results of which were published in 1928.

Exploration was undertaken by private companies from July 1923 onwards with limited geological and geophysical reconnaissance surveys by several groups. In

a report in the *Sydney Morning Herald* 25 April 1931 (p. 10), pre-eminent Australian geologist Professor Sir T.W. Edgeworth David (Professor Carey had a large photo of his former teacher and mentor Edgeworth David in his office at the University of Tasmania) noted the difficulties and high cost of exploration in New Guinea and thought that geophysical methods would be required together with 'careful' geological survey over a period of 'some years' to find payable oil fields. Largely because of the reports by Anglo-Persian, Oil Search Limited was incorporated in Port Moresby on 17 January 1929 having previously carried out exploration in Queensland. Shortly after its incorporation, the company acquired Oriomo Oil Company, which had drilled 16 shallow wells in Papua between 1927 and 1928 (Rickwood 1990, www.oilsearch.com). The company showed tremendous resilience, faith and patience – it received its first production revenues in 1992, 63 years after its incorporation (https://www.oilsearch.com/who-we-are/history).

The company acquired additional permit areas (Papua Permits 5 and 7) and expanded its geological staff through the 1930s. It continued to do extensive fieldwork, with Carey arriving in 1934; other Oil Search Ltd team members included E. Edwards, H.A.J. Fryer, J. McKinnon, J.N. Montgomery, J.C. Pratt and G.A.V. Stanley (McCarthy 1963, Rickwood 1992). McCarthy (1963, p.150) said of Montgomery:

> *The field manager and leader of all the field parties was a distinguished, hard-working geologist named Montgomery, one of the most vigorous men, physically and mentally, that I have met despite his size of no more than five feet. He was a first-class oil man and demanded that his staff should be of equal calibre.*

In 1936 the conditions under which prospecting for petroleum could be done in Papua and New Guinea were made more liberal and as a result, exploration activities greatly increased (Nye & Fisher 1954). In 1938 further ordinances were passed promulgating a modern petroleum code similar to those of Great Britain and New Zealand (Rickwood 1990). Permits held by Oil Search, Stanvac (Standard Vacuum New Jersey, a joint venture of Standard of New Jersey and Socony-Vacuum in the Far East, now ExxonMobil) and the Anglo-Persian Oil Company (now BP) were pooled in 1938 and operated by the Australasian Petroleum Company (APC); Oil Search Ltd staff were seconded to APC (Rickwood 1990, Pratt 2000).

In 1938 the first major aerial photographic survey was carried out, primarily to elucidate the broad geologic features. In this area of high rainfall and low cloud there was an average of only 18 minutes of effective flying time per day (Rickwood 1992). Topographic maps at scales of 1:40,000, 1:100,000 and 1:250,000 were produced over an area of 28,000 square miles (72,000 km^2). The new maps had a dramatic effect on the progress of mapping in the field, and subsequent surveys carried out, including those by Carey of the Purari and Vailala area of Papua, are classic references and facilitated progress in geological understanding (Rickwood 1992). In 1939 a palaeontological laboratory was set up in Port Moresby under the direction of Dr Martin F. Glaessner, who had come from Anglo-Persian. Glaessner's work made possible the zonation of the Cenozoic and correlation of Papuan stratigraphy with the Dutch East Indies (Rickwood 1992).

As a result of its investigations the Australasian Petroleum Company selected its first site for a deep test at Kariava on the Vailala River (fig. 1): an anticline had been identified from air photographs and confirmed by field geology (Rickwood 1990). Drilling operations were suspended on 10 January 1942, because of the Japanese offensive in New Guinea, when the well had reached a depth of 5117 feet. Drilling was resumed in March 1946, and the well was finally abandoned in April 1948 at a depth of 12,621 feet (3847 m). Some small gas shows were recorded, but the results were generally disappointing (Nye & Fisher 1954).

Due to the Japanese offensive, exploration largely ceased in January 1942 and remaining APC staff were evacuated to Australia.

FIELDWORK METHODS AND OBSERVATIONS

Transport by water was essential in New Guinea where there were no roads and before air transport became readily available. Coastal steamers provided initial transport around the coast and then smaller vessels were used in rivers until such time as walking became the only means by which the work could be carried out.

Oil Search Ltd developed a methodology based on systematic surveying and field geology rather than early drilling. The work involved:

- reconnaissance and follow-up more detailed mapping as required
- palaeontological studies to control the stratigraphy; local and regional correlation of stratigraphic sections; structural geology to define potentially prospective structures and regional tectonics
- petroleum indicators with search carried out in the field and previous reports.

Field parties usually comprised one or two geologists and a surveyor with support from local people, and was carried out largely by plane-table traversing with telescopic alidades and stadia rods of river and stream sections. In smaller creeks, navigation by prismatic compass might be utilised and sometimes stakes were set at 100-foot intervals.

Carey himself provided some wonderful insights into his *modus operandi* in reminisences published half a century later (Carey 1990) and illustrated by the following quotes:

> *No base maps.*
> *Mapping by chain and (prismatic) compass and plane table traversing with telescopic alidade distances being measured by stadia.*
> *To go to a place a hundred kilometres away, I walked.*
> *Leaving base camp, I would not expect to see another white man for several weeks, only neolithic natives* [sic], *many of whom had not seen a white man before.*
> *The only fresh meat was that which I shot.*
> *I kept a working yeast bottle to leaven my bread.*

Mail reached base camp every six weeks.
(Away from base camp) no radio communication or news broadcasts.
Hydrocarbon occurrences noted: oil and gas seeps, rocks with 'kerosene' smell.
Crocodiles – I fired my Webley forty-five at it, but it did not even budge...Montgomery fired his Winchester... that night they had a great feast of fresh crocodile.

The author recalls Professor Carey (on more than one occasion) regaling all with tales of using the filament from a spider's web as crosshairs in his theodolite.

River access

Most traverses were on rivers transverse to major structures: a collage of photographs taken by Carey around 1936, illustrating aspects of this work, is shown as plate 3. The larger rivers were accessible for some distance by small coastal vessels. The Oil Search Ltd parties often made use of the *Orion*, an auxiliary yawl of 19 tons. The other main form of river transport was motor canoes – simple dugouts made on the spot and usually less than 50 feet long. The canoes were generally utilised in pairs, one with the alidade and plane table, the other as the surveyor's scale either carried vertically or painted horizontally on the vessel (plate 3B, E); sometimes one was used as a simple outrigger, at other times a deck was lashed between two canoes. Motor power was provided by outboard motors of 4 to 22 horsepower. Carey noted that: 'if travelling at night passengers can sleep comfortably on stretchers and a table can be set up for meals and a galley fire built on a clay pan' (Carey 1941, Appendix 1, p. 4). Beyond the limits where motor canoes could access, light paddle canoes were used (plate 3B).

Aerial reconnaissance

Observation flights were initiated by APC as a reconnaissance tool in 1937. Carey undertook aerial studies of the morphology of the Owen Stanley Range and the Yodda Valley in October 1937 and examined large areas of the Gulf of Papua in April 1938. In May 1938 he flew from Port Moresby to Salamua (then a small town situated on the northeastern coast, built on a minor isthmus between the coast with mountains on the inland side and a headland; the closest city is Lae) via Yodda and Chirima Valleys on the north side of the Owen Stanley Range and returned via Wau, Mt Lawson and Mt Yule on the south side of the Range. He also made a return flight along the length of New Britain.

Carey carried out aerial photographic mapping and reconnaissance of the Central Highlands from 14 February

PLATE 3 – Life in the field, New Guinea circa 1936. The photos are scanned and enhanced from Carey's thesis. **A.** Geologist's camp on the lower Purari River; Orion moored next to camp. **B.** Hauling geological survey transport canoes in the Averi River, Gulf of Papua. **C.** Lunch stop, delta country, Gulf of Papua; K. McKinnon on the left, Carey on the right. **D.** Fly camp, delta country, Gulf of Papua (J.N. Montgomery nearest to camera). **E.** K. McKinnon improvising stadia rods from bamboo.

to 9 March 1939. The work was undertaken while travelling as a passenger in a Ford Trimotor on its flights across the mountains between Wau (fig. 1) and its survey assignment in Papua. K. Washington Gray (*in litt.*, 17 October 1939) noted increasing interest in the Central Highlands at that time and that Carey's tasks included having to "trace the extension of the great sequence of Mesozoic sediments then discovered" and "obtain a preliminary conception [*sic*] of the geology of the central highlands". An example photograph is included as plate 4.

The practical difficulties of aerial observation and recording over hostile terrain in various weather conditions (in poor weather the geologist took the co-pilot's seat and became navigator and observer for a reconnaissance flight) can hardly be comprehended to the modern geologist, but Carey undertook the task with his customary zeal and meticulous planning. In an appendix to his report (Carey 1939) he provides an account of the methodology and details the necessary equipment:

- suitable clothing for working at altitude
- amber glasses for eliminating haze
- binoculars
- camera (preferably operated by another person)
- prepared map (including all known topographical information, radial course lines, magnetic bearings, approximate flying times)
- scribbling map at same scale
- spring bows set to 5 minutes flying on base map;
- protractor scale
- prepared notebook (ruled with longitudinal medial line marked off in minutes on the scale of one inch to the minute of flying time).

CAREY IN NEW GUINEA

Carey's work in New Guinea is conveniently divided into two phases, separated by a period of six months' leave he took in the second half of 1938 to return to Sydney to write the thesis for which he was awarded a Doctor of Science from the University of Sydney.

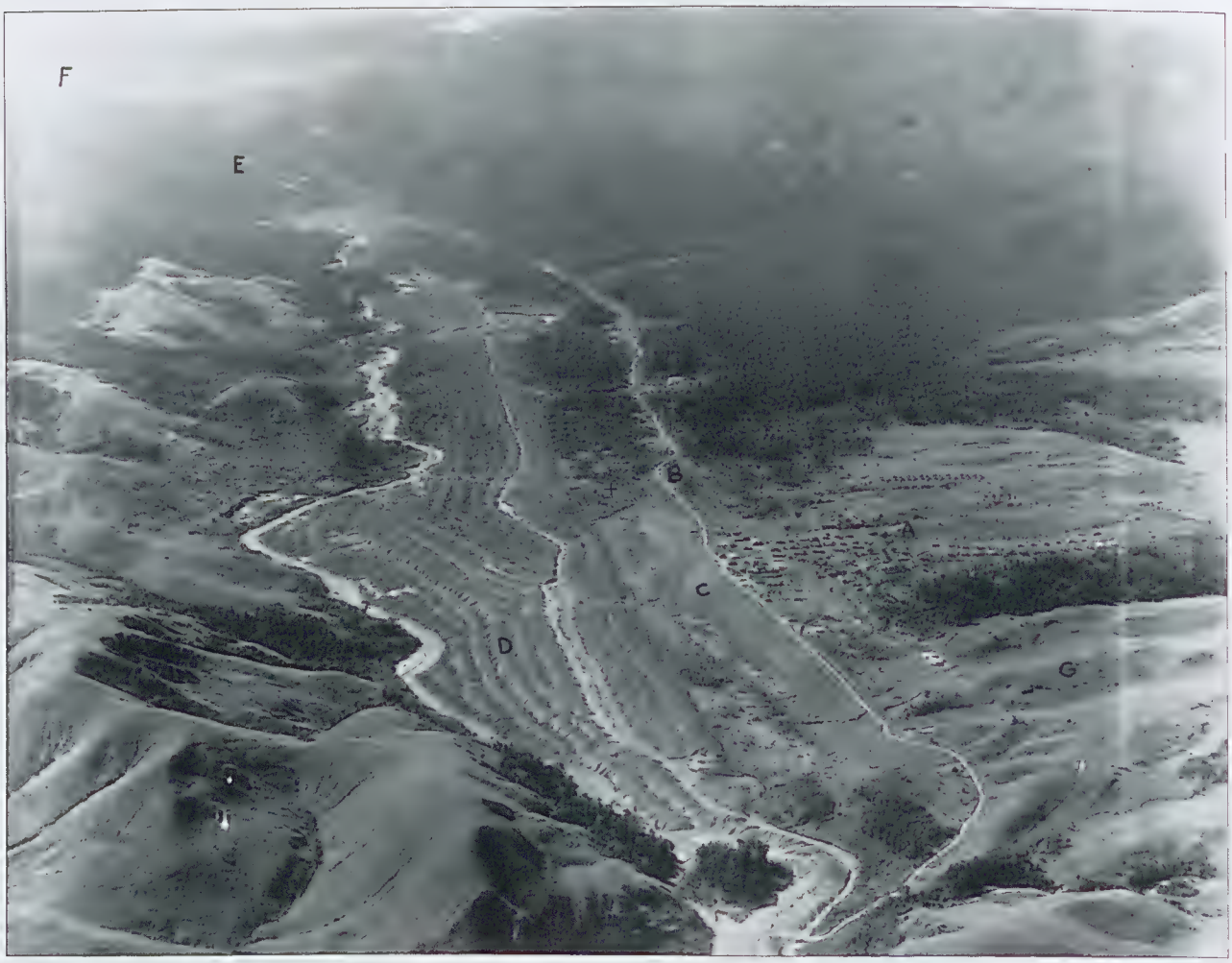

PLATE 4 – Example photograph of Carey's aerial reconnaissance undertaken for APC. The original caption reads "Bulolo Valley at Bulolo, looking southeast. Bulolo Gold Dredging Company's main camp (A) middle right; Wau-Bulwa road (B) in centre; Bulolo aerodrome (C) flanking road; dredge tailings (D) flanking the Bulolo River. The valley becomes constricted in the distance (E) owing to a cross upwarp of hard porphyry and phyllite, but beyond the constriction widens again to Wau near (F). The low grassy hills (G) belong to the Otibanda Series; the wooded hills are Kaindi Series, with intrusions of granites and porphyries. (APC Photo)."

Phase 1: 1934–1938

Carey commenced work in the Mandated Territory of New Guinea in 1934, arriving in Boram (5 km from modern-day Wewak; fig. 1) via Port Moresby and Rabaul (at the eastern end of New Britain) and subsequently worked over much of both New Guinea and Papua. His work included geological mapping, report writing and review, and administrative duties. In the field, he also prepared material for micro-fossil identification and assisted in identification and classification. He also made thin sections for petrographic studies.

He then spent several months examining the stratigraphy and structure of the Neogene succession of the Sepik Valley (fig. 1). It was at this time that the widespread occurrence of faulting was recognised in the Neogene folds. In June and July 1935, he worked in the Prince Alexander Mountains (fig. 1) on the northern coast of New Guinea and made a south-to-north section. In September 1936 he undertook a scout reconnaissance section across the Torricelli Mountains and recognised that most of the structures were related to shearing stresses. He then spent several months mapping in the Sepik Valley region where he first demonstrated the existence of an unconformity between the Oligocene to Lower Miocene Aitape Series and the Neogene Finsch Coast Series. Carey subsequently recognised three main biostratigraphic groups, separated by unconformities, in the Tertiary succession of New Guinea (table 1).

Shortly before noon on 20 September 1935, Carey was working in the Wapi district in the Senu River, south of the Torricelli Mountains (fig. 1), when his party was struck by one of the largest recorded earthquakes in New Guinea's history (magnitude 7.9). Carey (1935, p. 8) vividly described how his terrified workers:

> *... were first thrown to the ground, and picked themselves up, only to be thrown again and again. I fell on my knees and supported myself against a stout bamboo thicket and concentrated my attention on hanging on and watching the falling timber. I was shaken so violently that it was not easy to tell which trees were falling. Waves developed on the river and broke on the shore like surf. The traverse station I had just vacated was buried under a crumbling cliff.*

A second earthquake followed about 30 minutes later, severe, but less intense than the first. Aftershocks continued for the next full day and continued with lesser intensity for the next two months (Carey 1990).

Understandably, Carey's workers were terrified by the earthquake and its aftershocks. They packed his gear into boxes and prepared to move out. He:

> *... chided them soundly for their cowardice, and set all hands to work putting the camp in order ... I explained to them, as clearly as pidgin-English would allow, just what an earthquake was—pointing out its wide extent and showing them the futility of trying to run away from it.* (Carey 1935, p. 9)

The earthquake was also experienced by a party led by Montgomery conducting an exploratory reconnaissance on the lower Sepik River (fig. 1). Montgomery and his surveyor H.D. Eve described 'a sudden hush, followed by a loud rushing sound and almost instantly the ground was rocking with an undulatory motion of such rapidity and intensity that it was impossible to remain upright without support'. Some days later:

> *... as the party proceeded towards the Torricelli Mountains, fallen houses, ruptured ridges, and landslides became increasingly frequent ... the southern slopes of the main portion of the Torricelli Mountains, which previously had been densely forested, showed great stretches bared to bedrock and steep slopes replaced by cliffs.* (Carey 1935, p. 13)

At various times during 1935–1936, Carey worked with Montgomery, Edwards and Fryer to map the Maimai Dome (Montgomery & Carey 1936, fig. 1), which was seen as a potential hydrocarbon-bearing structure – a postulated Aitape Series buried hill beneath an anticline 5.5 x 1 miles in areal extent with a vertical closure of 1400 feet. The structure is about 64 km from the nearest coastal harbour at Aitape and access was difficult, the best being 56 km northwards from the Sepik River over swamp, forested plains and hilly country. It was noted that villages were comparatively small, and the area was situated between Mikili and Maimai, two mutually hostile clans.

The work was carried out in several phases:

- reconnaissance by Montgomery in October 1935 detected the structure
- reconnaissance mapping by Carey, Edwards and Fryer
- mapping by Edwards and Fryer at three inches to the mile ('the former standard')
- further work requiring mapping by Carey and Edwards
- follow-up ('"to gather up loose ends and cover some blanks") by Edwards and Fryer in May 1936.

The absence of seeps over the structure was seen as a negative and boring was recommended to determine if the structure contained petroleum in commercial quantities; further regional reconnaissance surveying and geological studies to determine the presence of hydrocarbons was also recommended (Montgomery & Carey 1936). The author has found no evidence that the structure was ever drilled.

In 1936, Edwards and Carey (1936) described the lithotypes present in the Aitape and Finsch Coast Series throughout the Sepik Basin ('Geosyncline'). The Aitape

TABLE 1 – Carey's identification of the main biostratigraphic groups, separated by unconformities, in the Tertiary succession of New Guinea (letters refer to the Indonesian Tertiary Letter-classification).

Age	Unit	Key Foraminifera	Indonesian Stage
Latest Pliocene – Miocene	Finsch Coast Series		g
Oligocene – Early Late Miocene	Aitape Series	*Lepidocyclina*	d-e-f
Paleogene	Port Moresby Series	*Nummulites-Discocyclina*	a-b

Series comprised limestone, sand silt and mudstone with conglomerate and volcanics; a key fossil for recognition was *Lepidocyclina*. The authors noted the presence of great thicknesses of silty rhythmite, which they regarded as the result of the annual monsoon cycle. The Finsch Coast Series comprised limestone, mudstone, sandstone and siltstone and had a characteristic physiographic expression; six stages were recognised, with *Globigerina* the key fossil. During this period, Carey also made quick visits to islands off the north coast of New Guinea. Each has a volcanic origin, with Manam (fig. 1) being very active (Carey 1938b).

Carey took leave in Sydney during July and August 1936 and returned to New Guinea, commencing work in the Gulf of Papua (Territory of Papua) continuing structural mapping and resulting in the subdivision of the Neogene. In May 1937, he traced the edge of the Australian foreland (N–NW major monocline downthrown to the east, with significant Neogene thickening to the east) north and northwest from Kikori (fig. 1). From July 1937 to January 1938 the regional survey was extended from the Purari River to the Akaifu River (north of the Owen Stanley Range), including a reconnaissance expedition along the border of Papua and the Mandated Territory between the Vailala and Tauri rivers in November and December 1937 and down the Tauri River to the coast. Carey described this as 'uninhabited country (or) no-mans-land between mutually hostile clans' and noted that 'we knew we were being watched, all armed with bows and arrows'. In crossing the Pururi, Carey found a potentially large structure and a series of thick-bedded limestone.

During 1937 and 1938 Carey worked in the eastern Gulf region. In October 1937 he searched for gas seeps in the vicinity of the present town of Kerema (fig. 1), where seeps had previously been reported by Woolnough (1934). In early 1938 he carried out reconnaissance mapping down the western Tauri Valley from the border of the Mandated Territory to the coast at Kukipi (fig. 1); he also carried out mapping in the Murumie and Matupu rivers. He subsequently undertook a coastal traverse from Kukii to Yule Island and in May 1938 reviewed Gulf Coast structures between Popo and Yule Island (fig. 1).

Before the Oil Search Ltd Papua permits were transferred to the Australasian Petroleum Company, Carey compiled a major report on permits 5 and 7 (Carey 1938a). The report comprised detailed sections on physiography, stratigraphy (subdivided into Upper Neogene, Lower Neogene and Paleogene Series), analysis of the Tertiary succession in the Gulf of Papua, a review of Tertiary micro-faunas in the Gulf of Papua, structural correlation of the Tertiary of New Guinea, structural conditions in the Gulf of Papua and a section on petroleum which included an inventory of all known petroleum indications.

Arthur Wade said of the report (*in litt.* 11 Aug 1939, unpublished): 'In spite of Mr Carey's tendency to be a little dogmatic at times, his report is a valuable contribution to the knowledge of the Geology of New Guinea.'

A break from fieldwork: doctoral thesis 1938

Carey took six months' leave from June to December 1938, during which time he returned to Sydney and completed and submitted a thesis (Carey 1938b) entitled 'Tectonic Evolution of New Guinea and Melanesia' for which he was awarded a Doctor of Science degree from the University of Sydney in 1939. In the thesis, Carey noted that it was the 'reading and reflection' stimulated by his early fieldwork for Oil Search Ltd in which many of his tectonic ideas were developed. The thesis is in two parts: the first dealt with the morphology, stratigraphy and structure of New Guinea; the second with the nature, origin and evolution of the 'island fringe of Australia'.

In dealing with structure, Carey noted that almost every anticline bears the stamp of rotational stress either in the configuration of its axis, its relation to its neighbours, or its association of compression and cognate tension. Almost every thrust tells the same story, either by its place in the fault pattern, by its attitude, by the trend of the slickensides, or its association with a complementary thrust tend. The mountain orogens bear similar testimony, both in their internal architecture and their external trend.

He recognised:

- master faults running for hundreds of miles though the country, terminating all other structures;
- strata on either of the faults appear to have been folded and faulted independently
- structures between the master shears are always oblique.

Carey postulated that the regional folding and rotation resulted from 'great master shears' and that the whole New Guinea region bears the stamp of a 'colossal shear system', which he termed the Melanesian Shear System; furthermore, the stresses responsible were continental in scale: 'New Guinea has been sheared westwards under a colossal shear system, on a scale grander than has yet been demonstrated anywhere else on the globe' (Carey 1938b, p. 62).

In the second part of the thesis, he extended his hypothesis outside of his field area into the Indonesian Archipelago and beyond. At this time, Carey clearly believed in the large-scale horizontal movement of continents (Carey 1938b):

- He figured Du Toit's (1937) reconstruction of Gondwanaland (Carey 1938b, figs. 30, 31) and said of him: "developing the great new highway of thought blazed by Wegener, has prepared a masterly synthesis of the Gondwana continents for the Palaeozoic and Mesozoic eras" (Carey 1938b, p. 81).
- He quoted Professor Arthur Holmes (Holmes 1928) making 'an important contribution from the theoretical side and discussed sub-crustal convection movements arising from differential radio-active heating as a mechanism of orogenesis' and that Holmes' theory of sub-crustal convection movement satisfactorily accounts for the tectonic facts of Melanesia (Carey 1938b, p. 88).
- He also quoted Andrews (1938): 'Wegner by this imaginative excursion, was led to infer the impermanence of position of the major structures of the Earth, such as the continents and oceans' (Carey 1938b, p. 93).

To explain the palaeogeography of Melanesia, Carey postulated either large continental areas had foundered to oceanic depths or that continental material had moved great horizontal distances. He favoured horizontal displacement as there was no direct evidence of foundering and a growding body of evidence that island blocks had been displaced horizontally. He concluded that continents may be disrupted or torn apart, but they may not be foundered to a great depth.

Carey noted that his thesis commenced with seemingly routine parochial survey in New Guinea and finished with a philosophy of the Pacific: 'All real scientific progress, and all initiation of new trends in thought are based on bold, but intuitively guided imagination' (Carey 1938b, p. 100).

Phase II: 1939–1942

On his return to New Guinea, Carey commenced work in the Gulf of Papua studying the Neogene succession and undertaking structural mapping. For the first time, air photographs were available and brought an enormous advance, as it was now possible to extrapolate between creeks.

For the remainder of his time in New Guinea, Carey was involved in the Purari region of Papua (Carey 1941, 1942, fig. 1). Between 1939 and 1940 he led investigations of the Lower Purari and Vailala rivers (Carey 1941) – primary tasks were mapping (four inches to the mile, plate 5), the search for direct evidence of petroleum and study of the Neogene succession. Three main surveys were conducted:

- Middle Purari Survey, 10 April to 21 July 1939
- Trans Purari Survey, 13 September to 29 December 1939
- Hathos Gorge Excursion, 5 March to 3 April 1940.

Carey (1941, Appendix 2) noted potential problems with and between local clans in the Lower Purari area, no doubt reassured by 'three police officers, each with a Lee Enfield 303 rifle…two boys [sic] each with a shotgun [and] myself with rifle and revolver' (Carey 1990, p. 21).

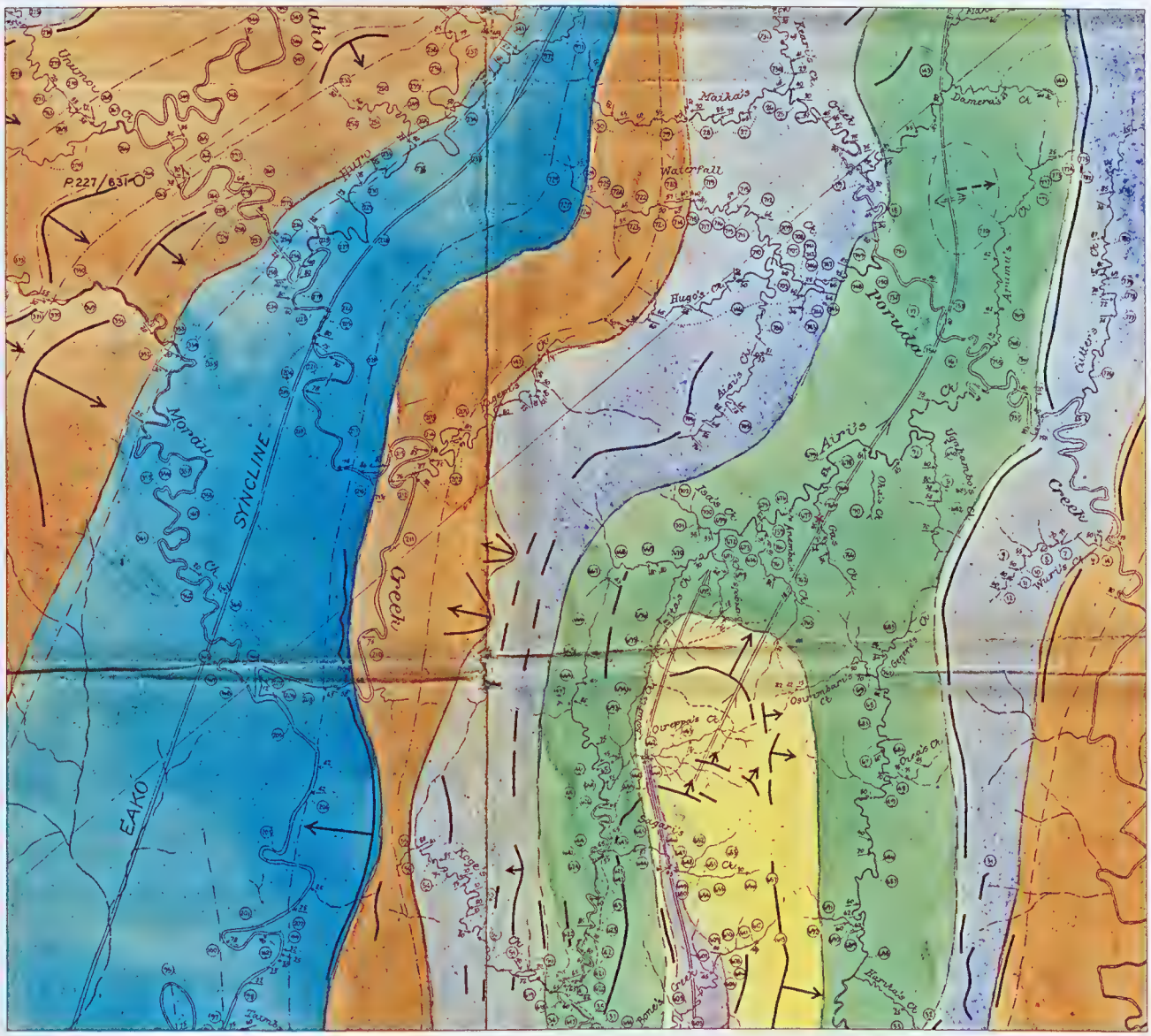

PLATE 5 – Detail of map of Vailala River area (Carey 1942; figure 12) illustrating detail of work undertaken. Information includes topographic information, stratigraphy, bedding dip and strike, sample points (numbers in circles), petroleum manifestations. Original map published at four inches to the mile.

The presence of 'most favourable' structural traps in the Purari region was recorded and Carey concluded that 'field evidence gives much more promise to lower part of the Upper Miocene'. He further noted that the Puri Limestone was a possible source rock succession, describing it as 'lithologically organic'. He also speculated on the presence of Paleogene source rocks.

In his report on the Puri Anticline (fig. 1; Carey 1940) it was noted that the structural feature was 22 x 4 miles in extent and within a belt of 'known manifestations of petroleum'. Five lithological subdivisions were recognised (Puri Limestone, Orbulina Marl, Toa Mudstone, Ena arenaceous group and Rapids Sandstone). He noted that a seismic (refraction) program was already underway. Carey's structural sections of the Puri Antlicline are shown as plate 6 – note the simple structure and lack of reverse faulting, although it can be inferred in Section CC. Plate 7 is the compilation map produced by Carey of the Oil Search Ltd work in the Gulf country through the Owen Stanley Range to the Markham River area on the north coast.

CAREY'S CONTRIBUTIONS

Carey and his colleagues carried out a heroic campaign of geology-based field exploration under the most difficult of conditions. Although their work did not find commercial hydrocarbons (drilling of the first well commenced in 1942, was suspended because of the Japanese invasion and was completed – as a dry well – after the war), it paved the way for PNG's current hydrocarbon industry.

The work became the classic reference for the areas and made enormous progress in geological understanding (Rickwood 1990). Rickwood also stated that 'the immediate advances in geological mapping and in geological thinking which followed the first photogeological work were probably the greatest single step ever made in understanding the geology of Papua New Guinea' (Rickwood, 1990, p. 6). It also paved the way for 1:250,000 scale mapping of all of PNG by the Australian Bureau of Mineral Resources 1950–1979 and this benefited both the petroleum and minerals sectors.

Largely driven by the presence of numerous oil and gas seeps which were first recorded as early as 1911, the Oil Search/APC exploration campaign was almost entirely directed towards Neogene rocks, with Paleogene and Mesozoic successions being regarded as non-prospective. Conventional thinking at the time was that the hydrocarbons in the seeps were sourced from carbonaceous rocks of Tertiary age (e.g., Woolnough 1934).

Carey (1936, p. 1) commented on a reported seep in the Ramu Valley some 35 miles southwest of Nubia (fig. 1). He met the gentleman who reported it and noted: 'I gathered what particulars I could without displaying much interest'. He also noted there were no maps and thought that an exploratory trip would take one to two weeks. Unfortunately, they were looking in the wrong place: it is now known that most of the hydrocarbons in the Papuan Basin (with the notable exception of the twenty-first-century giant Elk-Antelope discovery) are sourced from Late Jurassic mudstones, reservoired within Early Cretaceous (Berriasian) sandstones and sealed by Mesozoic age (Berriasian–Turonian) clastic successions (Davies *et al.* 1996, Hill & Hall 2003, Karwagle 2007).

Carey (and his co-workers) understood the difference between bio- and lithostratigraphy and time and time-rock units, and used fossil determinations to help subdivide the Neogene stratigraphic units (in this context, the work of Dr Martin Glaessner was critical). The work was published by the Australian Petroleum Company (1961) where five Papuan Stages were defined: the Kereruan (Late Oligocene to earliest Miocene) characterised by shallow-water 'larger' foraminifera known from the Indonesian Te Letter stage; the Taurian (mid Early to mid Middle Miocene) characterised by shallow-water 'larger' foraminifera known from the Tf1-2 Letter Stage; the Ivorian (late Middle to early Late Miocene) characterised by shallow water 'larger' foraminifera known from the Indonesian Tf3 Letter stage; the Kikorian equivalent to both the Taurian and the Ivorian; and the Muruan (Late Miocene) characterised by 'smaller' foraminifera including planktonic species of deep-water deposits. By 1961 the Australian Petroleum Company had discontinued use of these local stages in favour of applying European chronographic nomenclature to the Papuan successions and significant advances in global foraminiferal biostratigraphy and chronostratigraphy of the latter part of the twentieth century made the Papuan Stage names superfluous (Haig & Perembo 1990).

He recognised tectonic control over New Guinea geomorphology and named the Sepik Geosyncline (Basin) to encompass the conspicuous strike valleys north of the cordillera (pl. 8). This structural and physiographic feature traverses the length of New Guinea – from Huon Gulf responsible for the valleys of the Markham, Ramu and Sepik rivers, the Iddenberg, Wouffaer and Wapenga rivers in western New Guinea, and then emerging into Cenderawasih Bay (the prominent triangular-shaped bay east of the Birds Head at the western end of the island of New Guinea, see inset fig. 1; termed "Geelvink Bay" by Carey). He described the Central Highlands as a geanticlinal complex, between the Sepik-Ramu-Markham depression on the north and the Papuan Geosyncline to the south, modified by several powerful fault systems together with several distinct nuclei or uplift areas around which younger sediments have been faulted and folded (Carey 1939).

Carey, influenced by the pioneering work of Alfred Wegener, was an early believer in the concept of continental drift as evident in his thesis. He was aware of the massive tectonic movements responsible for the creation of New Guinea and noted that the cordillera system had raised Neogene marine beds to an altitude of 16 000 feet (4900 m) and 55 miles (88 km) from its front. Carey's inventive tectonic synthesis resulted not only in the Melanesian Shear but led to the globe encircling Tethyan Shear and Carey's "new global tectonics", arguably the basis of current plate tectonics.

The relevance of this heroic work was not long-lasting. Carey himself described the work as being carried out:

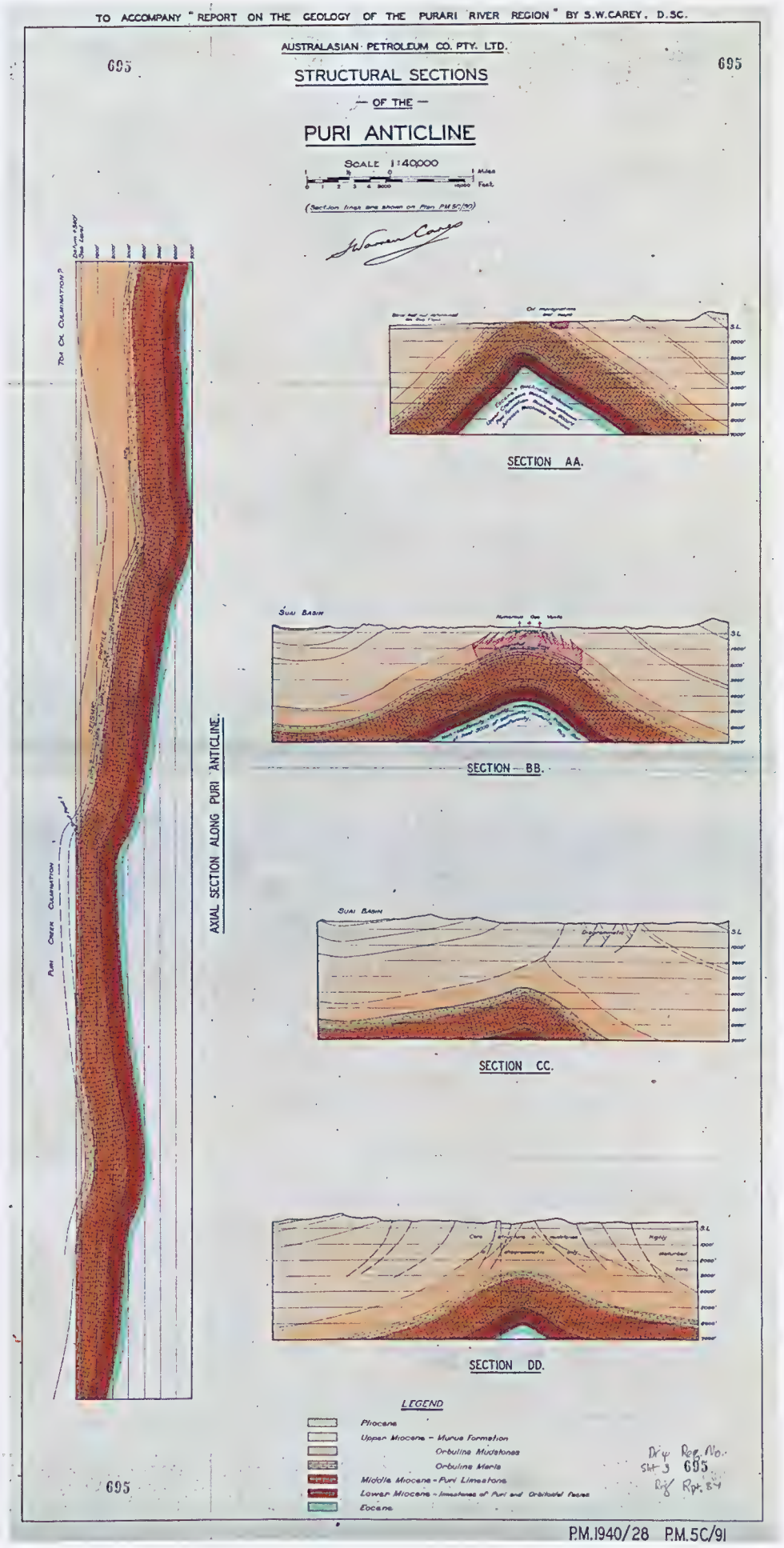

PLATE 6 – Interpreted structural sections, Puri Anticline (from Carey 1940).

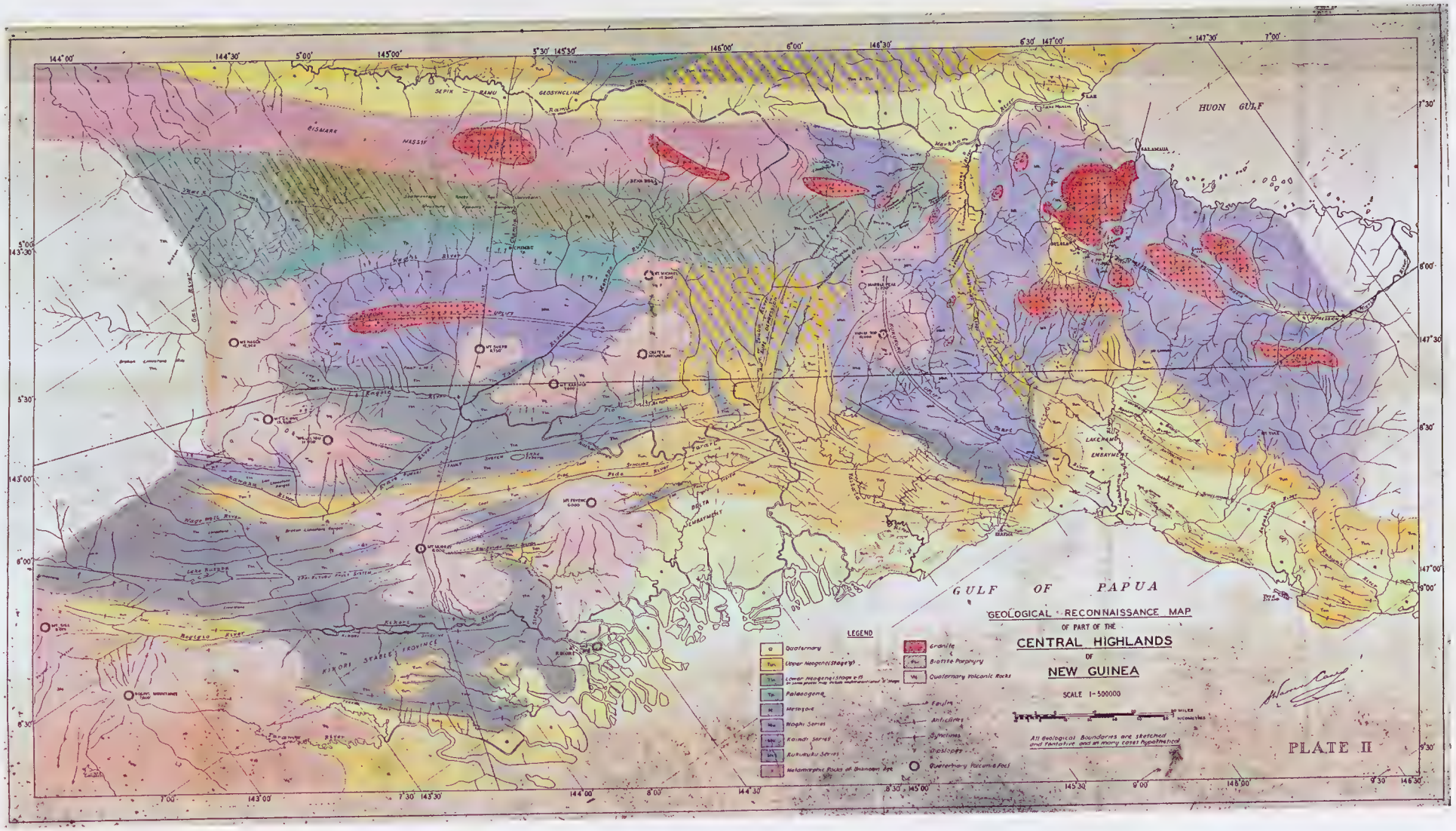

PLATE 7 – Compilation geological map (Plate II, Carey 1938a) of Gulf of Papua-Central Highlands-Markham River region; location indicated by red rectangle on fig. 1.

PLATE 8 – Interpreted morphological features of New Guinea (Carey 1938a and also included in his thesis as plate 1).

… at the end of the puttee and paddle period of field geology in New Guinea … at a time when the strand line was the boundary of the vast region of total ignorance … and being out of date within a very few years. (letter to Peter Purcell, 31 October 1969)

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(accepted 29 June 2021)

TASMANIAN MUSEUM AND ART GALLERY'S EXPEDITION OF DISCOVERY II – THE FLORA AND FAUNA OF MUSSELROE WIND FARM, CAPE PORTLAND, NORTHEAST TASMANIA

by Matthew Baker, Simon Grove, Miguel de Salas, Catherine Byrne, Lynette Cave, Kevin Bonham, Kirrily Moore, Laurie Cook and Gintaras Kantvilas

(with one text-figure, nine plates, two tables and one appendix)

Baker, M.L., Grove, S., de Salas, M.F., Byrne, C., Cave, L., Bonham, K., Moore, K., Cook, L. & Kantvilas, G. 2021 (15:xii). Tasmanian Museum and Art Gallery's Expedition of Discovery II – The Flora and Fauna of Musselroe Wind Farm, Cape Portland, Northeast Tasmania. *Papers and Proceedings of the Royal Society of Tasmania* 2021(2): 69–96. ISSN 0080-4703. Tasmanian Museum and Art Gallery, GPO Box 1164, Hobart, Tasmania 7001, Australia (MLB*, SG, MFS, CB, LC, KB, KM, LC, GK). *Author for correspondence. Email: matthew.baker@tmag.tas.gov.au

Flora and fauna surveys were conducted at the Musselroe Wind Farm property in 2018 and 2019 as part of the Tasmanian Museum and Art Gallery's ongoing research, collection-building and nature-discovery program. The property was found to have significant ecological and nature conservation values and this survey program increases the number of vouchered taxa known for the area to 1336 primarily from the targeted groups of vascular plants, bryophytes, lichens, butterflies, moths, beetles, freshwater invertebrates, snails and slugs. Many threatened taxa were recorded and several of the taxa, chiefly lichens and invertebrates, are new to science or new records for Tasmania. This survey significantly expands our knowledge of the flora and fauna of the Cape Portland area and serves as a baseline for a property with a mix of farming and environmental conservation management.

Key Words: Species discovery, biodiversity, multidisciplinary survey, Cape Portland, wind farm, threatened species.

INTRODUCTION

The Tasmanian Museum and Art Gallery's (TMAG) expedition to the Musselroe Wind Farm was the second in a series of multidisciplinary biological surveys conducted by the museum under the banner of its Expeditions of Discovery. The aims and rationale for the surveys, as discussed by Baker *et al.* (2019), are to: build TMAG's collections of flora and fauna from under- and poorly sampled parts of Tasmania; document the species of plants and animals present; discover new or hitherto overlooked species; and highlight the role that baseline species-discovery research plays in understanding and managing Tasmania's biota. The first expedition, conducted at the *Wind Song* property at Little Swanport in 2017, recorded 885 taxa, including several new to science or new records for Tasmania (McCarthy & Kantvilas 2018, Baker *et al.* 2019, Elix *et al.* 2019, Elix & Kantvilas 2020).

The Musselroe Wind Farm was chosen as it contains a diverse range of habitats, it has a limited number of vouchered collections held in museums and herbaria, and the project had the enthusiastic support of the land managers, Woolnorth Wind Farm Holding Pty Ltd. The survey focused on vascular plants, bryophytes, lichens, butterflies, moths, beetles, freshwater invertebrates, snails and slugs, with other taxonomic groups recorded opportunistically. Here we present an inventory and discussion of the plants, lichens and animals identified and offer an insight into a biodiverse corner of Tasmania. These results serve as a benchmark for future studies in other parts of Tasmania and to guide natural resource management on the property.

MATERIALS AND METHODS

The property

The Musselroe Wind Farm is situated in Tasmania's far northeast (fig. 1), approximately 20 km north of Gladstone. It is a mixed-use enterprise, managed primarily to produce renewable energy via 56 wind turbines, and with a secondary use of cattle grazing. The property covers about 5500 ha and is bordered by approximately 30 km of reserved coastline. A large proportion has been cleared for grazing and converted into improved pasture, and this area is also the footprint for most of the wind farm. The Cape Portland Wildlife Sanctuary (CPWS) (844 ha), a private reserve managed by the Musselroe Wind Farm, is located on the western side of the property. The location of the property relative to adjacent reserved areas is shown in figure 1.

The property has a diverse range of natural wetlands, six of which are listed in the Directory of Important Wetlands for supporting native plant or animal taxa or communities considered threatened at the national level (Environment Australia 2001). The survey area is dominated by low rounded hills formed from Jurassic dolerite interspersed with poorly drained flats of Quaternary sands of aeolian, marine and lacustrine origin (Jennings & Sutherland 1969). There are scattered Cenozoic basalt flows in the

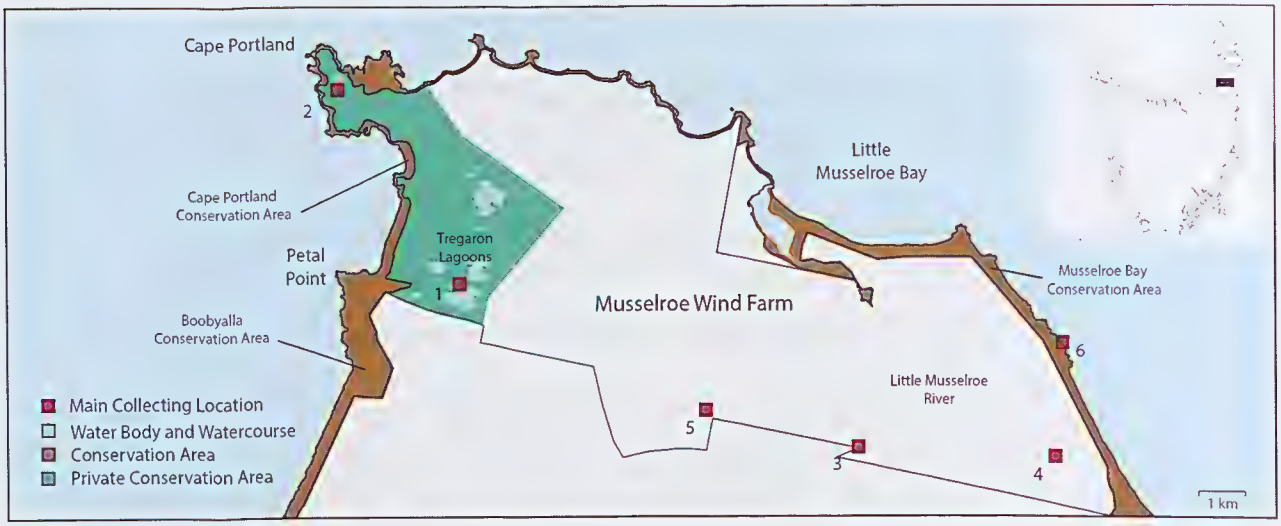

FIGURE 1 – Location of Musselroe Wind Farm: showing main collecting locations and reserve boundaries. 1: Tregaron Lagoons; 2 The Salties; 3: The Bullseye; 4: The Prairie; 5: Xanthorrhoea Ridge; 6: Abalone Rocks.

western half, as well as small exposures of the Cape Portland Complex, a Cretaceous intrusive porphyry, mostly west of Cape Portland Road. A small outcrop of Triassic sandstone is exposed just west of the original homestead. The easternmost extremity of the property is underlain by Devonian granite (McClenaghan 2005), which is exposed at the coast.

The climate of northeastern Tasmania corresponds to the Köppen classification of Cfb (temperate, warm summer, without dry season (Peel *et al.* 2007)). The nearest Tasmanian mainland weather station to Cape Portland is at Iarapuna/Eddystone Point, where average temperatures fluctuate from 6.9–13°C in winter to 13.9–21.1°C in summer. Modelling by LandTasmania, following methods prescribed in Webb *et al.* (2015), suggests average minimum temperatures of 4.5–6.5°C for July and 12.1–12.9°C for January, with average maximum temperatures of 13.1–13.5°C in July and 21.5–22.5°C in January (LIST 2020). Rainfall has a distinct peak during the winter months and is lowest during January and February, with an annual average of 754 mm (BOM 2020). Although there is a closer weather station at nearby Swan Island, its temperatures are strongly influenced by its small island location, and less likely to accurately reflect those at the study site.

Most of the Cape Portland property is farmland or land previously cleared for agriculture and now managed for conservation. The western two-thirds of the property (west of the Little Musselroe River) is improved pasture actively managed for cattle grazing. In comparison, the eastern third of the property consists of a mosaic of unimproved pasture, formerly managed for grazing but now managed for conservation as it supports areas of native vegetation. Significant areas of native *Poa* grassland occur in the area north of Tregaron Lagoons, between Charmouth Hill and Cape Portland. Native saline-tolerant vegetation is widespread in the Tregaron Lagoons area, along the northern coastal fringe south of Lanoma Point and along the shores of the Little Musselroe estuary.

A large area of coastal heathland containing a significant proportion of shrub and scrubland with a closed canopy occupies the eastern third of the property, in a triangle bounded approximately by the coast to the northeast, the Little Musselroe River and estuary to the west, and the southern boundary. Small but significant areas of *Melaleuca ericifolia* swamp forest occur along the course of the Little Musselroe River and at Tregaron Lagoons, while patches of *Allocasuarina verticillata* forest occupy higher well-drained ground along dune tops and ridges.

Over a period of about five years to 2018, substantial infestations of the declared weed species Gorse *Ulex europaeus* and African Boxthorn *Lycium ferocissimum* were controlled using Australian Government funding through NRM North. The works were undertaken in areas of high-priority native vegetation where livestock have been excluded. These sites continue to be managed for conservation. The farmland areas are maintained according to a weed management plan with weed infestations of Gorse, Horehound *Marrubium vulgare* and various species of thistle managed to minimise their spread into high conservation areas.

The area has been visited by biologists numerous times, particularly to undertake surveys prior to the establishment of the wind farm. Whilst extensive in their coverage, the results of those studies are not publicly available and have generated relatively few herbarium/museum voucher specimens which add value to data included in platforms such as the *Australasian Virtual Herbarium* AVH or *Atlas of Living Australia* ALA. Prior to this survey only 220 vascular plant taxa and about 165 animal taxa were formally listed for the area (ALA 2020, AVH 2020).

Expertise and timing

The survey involved four botanists and four zoologists from TMAG staff, as well as two honorary zoologist researchers. The property was surveyed during 5–9 November 2018, with follow-up invertebrate sampling and trap-sample

collection on 16 December 2018 and 16 January 2019, and additional flora, lichen and invertebrate sampling from 9–11 September 2019.

Sampling methods

Sampling was based on a strategic selection of survey sites that represented the major vegetation types and was confined mostly to de-stocked and regenerating areas (fig. 1). The major survey sites were allocated a local name for ease of identification (table 1) and each site was surveyed in detail to cover relevant habitats for target taxa.

Specimens of vascular plants, bryophytes and lichens were collected and lodged in the Tasmanian Herbarium, with limited duplicates distributed to other herbaria nationally and internationally under TMAG's formal specimen exchange program. Several vascular plant taxa were recorded only by observation due to sampling difficulties (e.g., tall eucalypt trees) or lack of fertile material. All possible substrata for lichen and bryophytes, including rocks, soil, bark, wood and charcoal, were examined.

Moths were collected mainly by ultraviolet light-traps. White sheets and bucket traps were used, but some were also collected from malaise traps set for general insect sampling. Beetles, other insects and other arthropods were sampled through a mix of direct observation, hand collection, including the use of hand nets and a beating tray, and trapping using malaise traps and yellow pan traps. These taxonomic groups were also collected from light-traps set for sampling moths. Molluscs were recorded through hand-searching and collection. Other invertebrates and vertebrates were recorded incidentally. Specimens were lodged in the TMAG Zoology collections, with some mollusc specimens retained by specialists until identifications were completed.

Information from all survey material curated and accessioned into the TMAG collection will be made available on the *Australasian Virtual Herbarium* and/or the *Atlas of Living Australia*.

Specimen identification

Specimens were identified utilising standard equipment and techniques, with comparison to TMAG's reference collections when necessary. Lichens were identified in the laboratory using low-power and high-power microscopy of hand-cut sections of the thallus (vegetative tissue) and apothecia (reproductive structures), mounted in water, 10% KOH, 50% HNO_3, lactophenol cotton blue, ammoniacal erythrosin and Lugol's iodine. Routine chemical analyses using thin-layer chromatography followed standard methods (Orange *et al.* 2010). Some moth specimens were identified using the reference collections of the Australian National Insect Collection (ANIC) (CSIRO, Canberra) and the Biosecurity Tasmania Insect Collection at the New Town Research Laboratories of the Department of Primary Industries, Parks, Water and Environment.

TABLE 1 — Main collecting sites at Musselroe Wind Farm

Site	Latitude	Longitude
Tregaron Lagoons	40°46'19"S	147°58'24"N
The Salties, Cape Portland	40°44'43"S	147°56'35"N
The Bullseye, Little Musselroe River	40°48'12"S	148°03'28"N
The Prairie	40°48'31"S	148°06'21"N
Xanthorrhoea Ridge	40°46'19"S	148°00'58"N
Abalone Rocks	40°47'14"S	148°06'01"N

Nomenclature and distribution

Vascular plant nomenclature follows de Salas and Baker (2021) and common names follow Wapstra *et al.* (2005). Nomenclature for mosses and liverworts is in accordance with the *Australian Moss Name Index* (ABRS 2018a), the *Checklist of Australian Liverworts and Hornworts* (McCarthy 2006) and *Tropicos* (Tropicos.org. 2018). Lichen nomenclature mainly follows McCarthy (2020). Nomenclature for land snails follows Stanisic *et al.* (2017). For all other vertebrate and invertebrate taxa identified to species, nomenclature follows the *Australian Faunal Directory* (ABRS 2018b).

Undescribed, partially identified or new species of insect are annotated with a unique epithet based on the registration number of an exemplar specimen from the TMAG collections, such as '*Euryglossa* sp. TMAG_F96120'. In cases where specimens can be associated with previously collected material, existing epithets are adopted. Insect specimens that could only be identified to a higher taxonomic rank than species are annotated with 'unplaced'. Moth distributions and rarity were determined, in part, by referring to specimens in ANIC.

RESULTS

Diversity

A total of 1417 taxa was recorded (table 2). This comprises 244 vascular plants, plus a further 119 collected in the past but not recorded in this survey (appendix 1.1); 33 mosses and seven liverworts (appendix 1.2); 206 lichens (appendix 1.3); and 735 invertebrates (714 insects, 5 spiders, 4 crustaceans and 12 gastropod molluscs) (appendix 1.4). In addition, five species of reptile, six species of mammal and 62 species of bird were observed or their presence detected (appendix 1.5).

Vegetation types observed were largely consistent with TASVEG 4.0 mapping (DPIPWE 2020). Smaller-scale unmapped features of interest include a dune, vegetated with an almost-perfect monoculture of Southern Grasstree *Xanthorrhoea australis* at Xanthorrhoea Ridge, and unmapped areas of *Melaleuca ericifolia* swamp forest along the western margin of the Musselroe Bay estuary. Skeletal sandy soils on granitic outcrops at the far eastern end of the property supported a heathland community distinct from other heathland areas. For vascular plants, the most species-

diverse sites were The Salties (57 taxa) (pl. 1), The Bullseye (40 taxa) (pl. 2) and Abalone Rocks (31 taxa) (pl. 3), with the main families represented being the Asteraceae (35 taxa), Poaceae (32 taxa), Fabaceae (29 taxa) and Cyperaceae (25 taxa). A low-rainfall bryophyte flora is dominated by mosses over liverworts, with the best-represented families being the Pottiaceae (9 species) and Bryaceae (5 species), both adapted to dry conditions. The most species-diverse sites for bryophytes are The Salties, with all 15 taxa recorded growing on soil and Abalone Rocks, where four epiphytes were found in dense shrubbery behind the beach and nine on rocks or soil. The property supports a diverse array of lowland, coastal, low-rainfall lichens, including many novelties (see below). The richest habitats for lichens are coastal rocks, with granite and dolerite supporting subtly different species assemblages; dry woodlands dominated by *Allocasuarina verticillata*, where lichens colonise wood, bark, rocks and consolidated soil; isolated large granite outcrops in scrubby heathland; and *Melaleuca ericifolia*-dominated swampy woodland, where the papery bark of the oldest trees supports a highly specialised suite of epiphytes (see below). Artificial habitats, including fence posts, treated pine rails and mortar, are also well-colonised.

The sites with the highest diversity in insect taxa lie in the eastern heathlands at The Prairie (181 taxa) (pl. 4); the Tregaron Lagoons environs (172 taxa) (pl. 5); and the landward portion of the Cape Portland headland beyond the enclosed paddocks (141 taxa). The most taxon-rich insect groups were the beetles (with 265 taxa), flies (147 taxa) then moths (136 taxa). A high diversity of moths was found in The Bullseye lagoon area, including several rare species and new records (see below). A number of characteristic or noteworthy invertebrates found during this survey are illustrated in plate 6 and plate 7.

Novelties

Flora

Botanical novelties were limited to the lichens and mosses. Twenty lichen taxa were recorded for Tasmania for the first time and are reported elsewhere (Kantvilas *et al.* 2020). These include: *Lecanora strobilina* and *Ramonia absconsa*, first records for the Southern Hemisphere, with the latter previously known only from the type collection from South Carolina; *Arthothelium endoaurantiacum*, *Collema crispum* and *Gyalecta pellucida*, first records for Australia; and *Austroparmelina corrugativa*, *Amandinea conranensis*, *Bacidia laurocerasi*, *Buellia extenuatella*, *Catinaria atropurpurea*, *Diploschistes euganeus*, *D. gyrophoricus*, *Endocarpon crassisporum*, *Lecanora pseudogangaleoides* subsp. *pseudogangaleoides*, *Opegrapha niveoatra*, *O. spodopolia*,

PLATE 1 – Succulent saline herbfield at The Salties (Cape Portland), dominated by *Sarcocornia blackiana* and *S. quinqueflora*.

PLATE 2 – The Bullseye, a freshwater lagoon flanked by *Melaleuca ericifolia* on the Little Musselroe River.

O. varia, *Physcia austrostellaris*, *Trapelia concentrica* and *Xanthoparmelia xerica*, all known previously from mainland Australia, with the last-mentioned otherwise known only from its type collection from South Australia. Whilst some of these novelties were recorded only during the survey, most were found to be already represented by unidentified existing herbarium specimens from other Tasmanian localities. Taxonomic work will continue on some as yet unidentified collections. The unidentified species of *Ramboldia* and *Trapelia* may well be new to science.

Several mosses represent significant range extensions in Tasmania, including *Brachymenium preissianum*, recorded from exposed lime mortar at the ruins of an old homestead at Home Beach within the CPWS, and previously known

PLATE 3 – Granite outcrops on the east coast of the property. These support a rich lichen flora with the reddish *Caloplaca gallowayi* often dominant.

PLATE 4 – Coastal heathland at The Prairie. The sparsely vegetated area in the foreground provides habitat for the threatened plant species *Stylidium beaugleholei*.

PLATE 5 – Lagoon habitat of the aquatic plant species *Myriophyllum muelleri* and *Stuckenia pectinata* in the southern part of the Tregaron Lagoons.

only from Hobart, and *Campylium polygamum*, previously reported only from Chimney Pot Hill (near Hobart) and Lake St Clair, and found on boggy ground at The Bullseye. The Australian endemic moss, *Archidium stellatum*, a species of dry areas, and previously reported for South Australia and Victoria, is a new record for Tasmania, recorded from exposed soil in windswept tussock sedgeland with outcropping dolerite at The Salties near Cape Portland.

TABLE 2 — Overview of taxa recorded from Musselroe Wind Farm and surrounding coastal reserves

Group	Total taxa	Introduced species
Vascular Plants	363	65
Dicotyledons	238	43
Magnoliids	3	
Gymnosperms	0	
Monocotyledons	116	22
Pteridophytes	6	
Bryophytes	40	1
Liverworts	7	
Mosses	33	1
Lichens	206	
Invertebrates – Lepidoptera	137	1
Invertebrates – Coleoptera	251	6
Invertebrates – Other Insects	326	1
Archaeognatha	1	
Blattodea	4	
Dermaptera	3	
Diptera	133	
Hemiptera	73	
Hymenoptera	89	1
Mantodea	2	
Mecoptera	1	
Neuroptera	4	
Odonata	1	
Orthoptera	15	
Invertebrates – Other Arthropods	9	
Araneae	5	
Amphipoda	2	
Decapoda	1	
Isopoda	1	
Invertebrates – Gastropoda	12	4
Vertebrates	73	6
Birds	62	5
Mammals	6	1
Reptiles	5	0
Total	1417	84

Fauna

Many invertebrate specimens remain unidentified or only partially identified (e.g., to family or genus level) and upon further research may well prove to be undescribed species or species newly recorded from Tasmania: these species are annotated with a '+' in appendix 1.4. Seven taxa are new to science: the fly *Axinia* sp. TMAG_F5984 and the beetle *Idiophyes* sp. TMAG_F98611 (both from the Tregaron Lagoons area); the moths *Limnaecia* sp. TMAG_F107740 (found at The Prairie) (pl. 7D), *Batrachedra* sp. TMAG_F99720, *Edosa* sp. TMAG_F99719 and *Peraglyphis* sp. TMAG_F99734 (all from The Bullseye lagoon area); and the snail *Scelidoropa* sp. 'Little Musselroe' (also from The Bullseye lagoon area). Four species were previously known only from the Australian mainland and are newly recorded for Tasmania: the beetle *Liparochrus* (not yet assigned to species) (Cape Portland headland trackway and Little Musselroe River crossing), and the moths *Scythrophanes stenoptera* (The Bullseye lagoon area), *Thallarcha phalarota* (Xanthorrhoea Ridge), and *Taxeotis intermixtaria* (eastern heathlands). Significant rediscoveries in a Tasmanian context include the fly *Acridophagus paganus* (pl. 7B; found in the eastern heathlands and on Xanthorrhoea Ridge) and the moths *Eutorna intonsa* (found at the Little Musselroe River crossing), *Araeostoma* ANIC sp. 01 (Cape Portland trackway and eastern heathlands), *Philenora* sp. TMAG_F108002 (The Bullseye lagoon area), *Paramsacta marginata* (The Prairie and Little Musselroe River crossing) (pl. 7C), *Barea atmophora* and *B. exarcha* (both The Bullseye lagoon area), and *Bida radiosella* (eastern heathlands). Two further significant rediscoveries are also threatened species and are discussed further below.

Threatened species

Flora

The Musselroe Wind Farm is known for supporting populations of threatened species, some of which, for example *Thelymitra antennifera*, have been monitored by the Tasmanian Department of Primary Industries, Water and Environment. In the present survey 12 vascular plant species listed as rare and two species listed as vulnerable under Tasmania's *Threatened Species Protection Act 1995* were recorded (appendix 1.1). Scarlet Sundew *Drosera glanduligera* (rare) is a new record for the area and was found growing in the southeasternmost corner of the property on poorly drained, moss-covered granite rock plates in shrubby heathland (pl. 8A) and in open heathland at Xanthorrhoea Ridge. Neither population is within reserves on the property. The parasitic herb Golden Dodder *Cuscuta tasmanica* (rare) was observed as large populations at two wetlands within the CPWS (pl. 8B), parasitising a range of species including Running Marshflower *Ornduffia reniformis*, Creeping Buttons *Leptinella reptans* and Prickfoot *Eryngium vesiculosum*. Roundleaf Wilsonia *Wilsonia rotundifolia* (rare) (pl. 8C) was recorded at Tregaron Lagoons as a common component of

PLATE 6 – **A**. The Darkling-beetle *Hyocis bakewelli*. **B**. The Belid Weevil *Stenobelus tibialis* on coastal *Juncus kraussii*. **C**. Salt-lake Slater *Haloniscus searlei*, a scyphacid isopod of saline lagoons listed as Endangered in Tasmania (photographed specimen is from Tunbridge Lagoon). **D**. The largely dune-dwelling Peacock-spider *Maratus tasmanicus*.

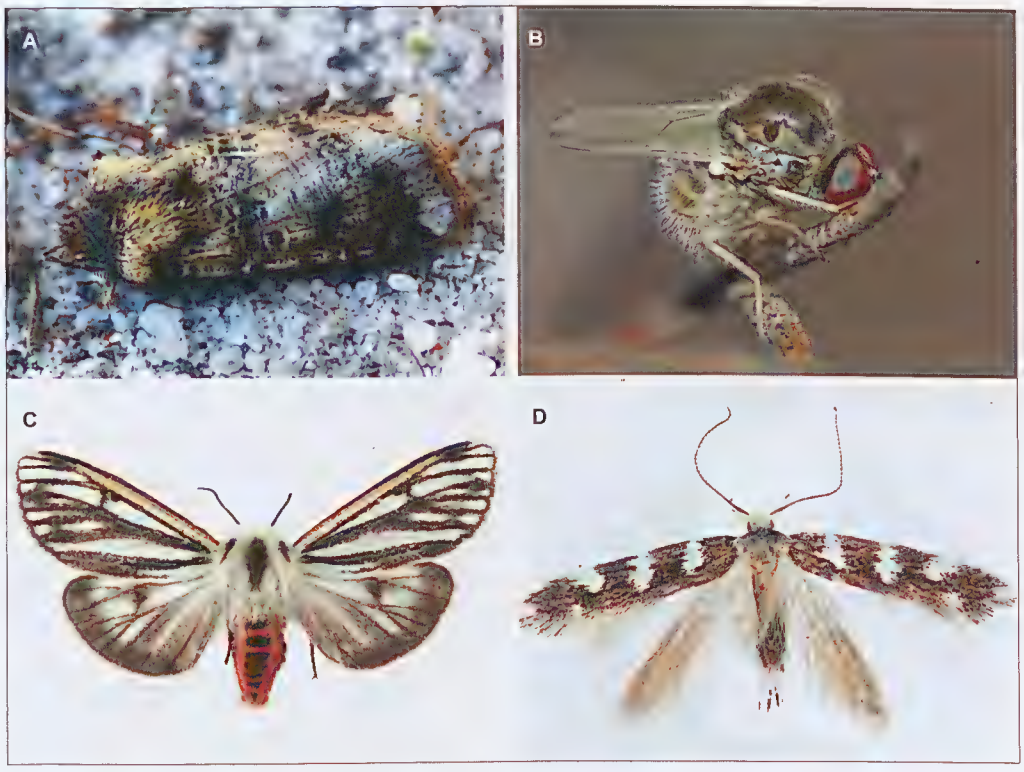

PLATE 7 – **A**. Male Variable Cutworm *Agrotis porphyricollis*. **B**. Mythicomyiine bee-fly *Acridophagus paganicus*. **C**. Male *Paramsacta marginata*. **D**. *Limnaecia* sp. TMAG_F107740.

PLATE 8 –Threatened flora recorded from Musselroe Wind Farm. **A**. Scarlet Sundew *Drosera glanduligera*. **B**. Golden Dodder *Cuscuta tasmanica*. **C**. Roundleaf Wilsonia *Wilsonia rotundifolia*. **D**. Silky Wilsonia *Wilsonia humilis*.

PLATE 9 – Introduced species recorded from Musselroe Wind Farm. **A**. Annual Beardgrass *Polypogon monspeliensis*. **B**. Prickly Sowthistle *Sonchus asper*. **C**. Water Buttons *Cotula coronopifolia*. **D**. Coast Barbgrass *Parapholis incurva*.

the dry lagoon margin flora, and outside of the CPWS at a dried-up wetland south of Lanoma Point. Silky Wilsonia *Wilsonia humilis* (rare) was recorded at The Salties, within the CPWS, but restricted to a few small patches amongst dolerite rocks on the margin of the saltmarsh (pl. 8D).

Juniper Wattle *Acacia ulicifolia* (rare) was recorded approximately 1 km east of the Little Musselroe River, close to the southern boundary of the property. Slender Velvetbush *Lasiopetalum baueri* (rare) grew as heavily wind-pruned shrubs at the rocky margin of the saltlake at The Salties. Helicopter Bush *Spyridium vexilliferum* var. *vexilliferum* (rare) was recorded at Xanthorrhoea Ridge. A small but locally common population of Sand Grasstree *Xanthorrhoea arenaria,* listed as vulnerable on the Tasmanian *Threatened Species Protection Act 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, was found south of the Little Musselroe estuary. This appears to be the first record of the species from the Musselroe Wind Farm property. Shining Dogwood *Pomaderris paniculosa* subsp. *paralia* (rare) was recorded from The Salties and at The Prairie.

Two threatened species of the aquatic genus *Myriophyllum* were recorded. Tiny Watermilfoil *Myriophyllum integrifolium*, a first record for the area and listed as vulnerable, was found adjacent to Xanthorrhoea Ridge. Hooded Watermilfoil *Myriophyllum muelleri*, listed as rare, was recorded in the southern part of the Tregaron Lagoons (pl. 5), with locally abundant Fennel Pondweed *Stuckenia pectinata*. The tiny ephemeral triggerplant, Blushing Triggerplant *Stylidium beaugleholei* (rare) was recorded at The Prairie where it is locally abundant (pl. 4). Tiny Arrowgrass *Triglochin minutissima* (rare) was recorded occasionally in soil accumulated in damp crevices amongst granite rocks on the coast of Great Musselroe Bay.

Sixteen further species of threatened vascular flora have been previously recorded from the area (ALA 2020) but were not observed during this survey (appendix 1.1).

No listed threatened species of bryophytes and lichens were recorded, although many non-vascular plants are considered uncommon and may well qualify for listing. For example, lichens include the naturally rare Tasmanian endemics *Bactropsora paludicola, Eugeniella farinosa* (only the second record) and *Porina meridionalis*, and the equally rare (in Tasmania) *Caloplaca pulcherrima*, *Ocellomma rediuntum*, *Ramonia absconsa* and *Gyalecta pellucida*, all restricted to *Melaleuca ericifolia*-dominated swamps, which are themselves a vegetation type of very high conservation value, especially for cryptogams. Other uncommon, noteworthy species recorded included *Arthothelium endoauranticaum* (from coastal scrub), *Endocarpon crassisporum* (from coastal grassland), and *Xanthoparmelia xerica* and the endemic *Lepra dactylinella* (from granite outcrops in heathland).

Fauna

A single adult male of the Schayer's Grasshopper *Schayera baiulus* (Driessen *et al.* 2020), listed as endangered on the Tasmanian *Threatened Species Protection Act 1995*, was collected (9 November 2018) from the dunes behind Lemons Beach. Its identification is provisional, because no other specimens of an adult male of this species are known from collections. The species was last recorded in 1988, when single specimens were found at Rushy Lagoon in the northeast, and Woolnorth in the northwest (Key 1991). Prior to that it was only known from the specimens associated with its original description (Erichson 1842, Key 1990).

Saline lagoons on the Cape Portland headland and towards the northern coastline hosted the salt-lake slater *Haloniscus searlei*. This isopod, an aquatic member of an otherwise terrestrial lineage, is associated with inland saline lagoons across southern Australia but is very rare in Tasmania, where it is listed as endangered and only known from two inland saline lagoons in the Midlands (Threatened Species Section 2021). Its presence in near-coastal lagoons at Cape Portland/Musselroe Bay is surprising and significantly enhances our understanding of the habitat requirements of this species.

Four threatened bird species and one threatened mammal species were observed. Hooded Plover *Thinornis cucullatus* (nationally vulnerable) were seen on all visited stretches of sandy shore, as well as on exposed windblown sand in the vicinity of the saltpans inland from the northern coastline. Fairy Tern *Sternula nereis* (vulnerable) were observed feeding just offshore along the northern coastline. Wedge-tailed Eagle *Aquila audax fleayi* (endangered) and White-Bellied Sea-eagle *Haliaeetus leucogaster* (vulnerable) were observed at various places on the property but no nests of either species were located. Tasmanian Devil *Sarcophilus harrisii* (endangered) scats were observed along many of the tracks walked and are known to occur in the general area.

Exotic and pest species

Forty-nine species of introduced vascular plants were recorded (appendix 1.1). Common agricultural weeds include Winged Slender Thistle *Carduus tenuiflorus*, Variegated Thistle *Silybum marianum*, Capeweed *Arctotheca calendula*, Horehound *Marrubium vulgare*, Great Brome *Bromus diandrus* and Sweet Vernalgrass *Anthoxanthum odoratum*. Two shrubs that have become dominant components in parts of the landscape are Gorse *Ulex europaeus* and African Boxthorn *Lycium ferocissimum*. At the ruins of the old homestead at Home Beach, several species of garden origin have become naturalised including Century Plant *Agave americana*, Bearded Iris *Iris* × *germanica* and Caper Spurge *Euphorbia lathyris*. This area also hosted many species of introduced grasses and herbs. Common introduced species in wetland habitats include: Annual Beardgrass *Polypogon monspeliensis* (pl. 9A), Prickly Sowthistle *Sonchus asper* (pl. 9B), Water Buttons *Cotula coronopifolia* (pl. 9C), Buckshorn Plantain *Plantago coronopus* and Coast Barbgrass *Parapholis incurva* (pl. 9D). Drier coastal habitats included: Sweet Melilot *Melilotus indicus*, Winged Slender Thistle, African Boxthorn, Gorse, Scarlet Pimpernel *Lysimachia arvensis* and Fourleaf Allseed *Polycarpon tetraphyllum*. Coastal beach and foreshore supported Searocket *Cakile maritima*, Marram Grass *Ammophila arenaria*, African Boxthorn, Sea Spurge *Euphorbia paralias* and Buckshorn Plantain. Largely weed-free areas include the main eastern part of the property east of the Little Musselroe River (The Prairie) and other areas

of intact heathland. Four species, Winged Slender Thistle, African Boxthorn, Gorse and Horehound are declared weeds under the Tasmanian *Weed Management Act 1999*. The invasive South African Weed Orchid *Disa bracteata* Sw., a significant weed on mainland Australia but in the early stages of invasion in Tasmania, was recorded in the area in 2013 (Wapstra *et al.* 2020), but not seen during this survey.

Sixteen further species of introduced flora were previously recorded from the area (ALA 2020) but not observed during this survey (appendix 1.1). Only one species of introduced moss, *Eurhynchium praelongum*, was found growing in a disturbed site at Xanthorrhoea Ridge.

Remarkably few introduced insect species were collected (appendix 1.4). The list comprises Honeybee *Apis mellifera*, Eleven-spotted Ladybird *Coccinella undecimpunctata*, Sea-rocket Flea-beetle *Psylliodes marcida* and the cow-dung-feeding Dor-beetle *Geotrupes spiniger* and *Aphodius lividus*, all of European origin; the first two are now widespread across the state; the third is a new record for Tasmania and Australia but has since been discovered at several other localities on the Tasmanian north and east coast in association with its non-native foodplant *Cakile* species; while the fourth and fifth are found primarily in the east and northeast. Two more beetle species, *Attagenus pellio* and *Necrobia rufipes*, both associated with carrion, are cosmopolitan although it is possible that in Australia and Tasmania they represent early European introductions (the former is associated with pelts and the latter with cured meats). Both are rarely recorded in Tasmania.

Four introduced gastropods, all widespread species of European origin, were found (appendix 1.4): Small Pointed Snail *Prietocella barbara*, Garden Snail *Cornu aspersum*, Hedgehog Slug *Arion intermedius* and Striped Field-slug *Lehmannia nyctelia*. A fifth European species, Garlic Snail *Oxychilus alliarius*, was found at Little Musselroe and is highly likely to occur on the property.

Nine native moth species considered to be agricultural pests were collected. Most were noctuid moths: Bogong Moth *Agrotis infusa*, Brown Cutworm *Agrotis munda*, Variable Cutworm *Agrotis porphyricollis* (pl. 7A), Sugarcane Stem Borer *Bathytricha truncata*, Native Budworm *Helicoverpa punctigera* and Southern Armyworm *Persectania ewinggi*. Two pest moth species from other families were the Small Tabby *Etiella behrii*, a pyralid which feeds on legumes, and the tortricid *Acropolitis rudisana*, which can be a pest on grapes. The only introduced lepidopteran recorded was the Cabbage White Butterfly *Pieris rapae*, another known pest species.

DISCUSSION

Although a significant proportion of the Cape Portland property has been converted to improved pasture for cattle grazing, it retains pockets of high-quality undisturbed native habitat, such as The Salties, The Prairie and Xanthorrhoea Ridge (table 1).

Open treeless areas show evidence of intense grazing pressure from the high density of macropods and Wombats *Vombatus ursinus*, particularly along the eastern side of the property, with grasses closely cropped to ground level. A significant proportion of open ground in the eastern heathlands is dominated by less-than-palatable spiny shrubs, including Prickly Moses *Acacia verticillata* and Ploughshare Wattle *A. gunnii*, as well as tougher sedges (especially *Gahnia* species) and Sagg *Lomandra longifolia*. In contrast, more palatable seasonal herbs were conspicuously rare or absent. The greatest diversity of insects was found in the eastern heathlands, including many habitat specialists. The seasonal moth fauna was largely typical of that which can be found during spring in coastal heathlands, and in vegetation dominated by *Allocasuarina*, *Acacia* and native and introduced grasses, apart from the notable absence of eucalypt feeders due to the almost total absence of *Eucalyptus* on the property. This collection included around 13% of the Lepidoptera in Tasmania. No Tasmanian endemic species were recorded, probably because vegetation types were typical of the more general southern Australian autochthonous flora. The eastern heathlands proved to be the most diverse site for Lepidoptera, with almost 60 taxa recorded. The fauna here was dominated by geometrid species that feed on *Acacia, Kunzea, Allocasuarina, Leptospermum* and low-growing shrubs such as *Epacris*. The noctuid fauna was also relatively diverse with 15 species; those with the highest abundance were grass-feeders such as the Variable Cutworm and agricultural pests such as Bogong Moth and Southern Armyworm.

The area surrounding the saline lagoons around The Salties and extending inland as far as the paddock fences is species-rich for plants and animals, perhaps due to the diverse mosaic of habitat types present in a relatively small area, including coastal grassland, saline and freshwater shallow lagoons, rocky marsupial lawn, rocky headland and foreshore, dunes, and seasonally wet grassland and heathland. In addition to The Salties, a pocket of high species richness in and around a shallow but permanent freshwater habitat supported *Melaleuca ericifolia* closed forest and regenerating grassland and heathland known as The Bullseye. Permanent bodies of fresh (rather than brackish or saline) water are generally rare on the property, and mostly associated with the course of the Little Musselroe River and areas of low elevation to the east.

Given the history of the Cape Portland property and its current land use, the relatively high number (65 taxa) of naturalised, exotic vascular plants is not surprising. Large tracts of the property consist of improved pasture and, consequently, contain many species of agricultural weeds. Most of these taxa are annual and perennial herbs and grasses, and were recorded in pastures, along roadsides and fence lines within the property and around areas of habitation. Many of the species of introduced plants are likely to have originated from past agricultural activities and the relatively high number of lepidopteran pests is likely a result of the modified agricultural environment prevalent in the area. Recent efforts to control invasive exotic plants have had a positive effect, with control of African Boxthorn being particularly successful. Many of the introduced plants recorded during the survey can

form widespread and intractable populations, including species such as Annual Beardgrass, Prickly Sowthistle, Water Buttons, Buckshorn Plantain and Coast Barbgrass. Small-scale infestations of Century Plant, Bearded Iris and Caper Spurge have most likely persisted at the site of the old homestead at the northern end of Home Beach since it was inhabited and have spread to a small extent to the immediate surrounding area.

Previous surveys of the property have recorded 16 species of threatened flora that were not identified during this survey. This could be at least partly due to this survey not coinciding with the flowering time of these species (particularly orchids), or the species having been recorded from areas or habitats not sampled in this survey.

The property has outstanding ecological and nature conservation values, although these are not evenly distributed: areas of enclosed pasture tend to have little value whereas the established reserves within the property have the highest. Notably, several threatened species occur outside of reserves.

The property contains large areas of vegetation that is highly susceptible to *Phytophthora cinnamomi* root rot, particularly high-density populations of Southern Grasstree *Xanthorrhoea australis*, small populations of Sand Grasstree *X. arenaria*, and large areas of damp heathland. The mosaic of heathland and scrub northeast of The Prairie has developed at least partly as a response to fire history, and future fire management will play a role on the proportions of these two habitat types.

Threatened beach-nesting shorebirds such as Fairy Tern, Hooded Plover and Sooty Oystercatcher *Haematopus fuliginosus* are very sensitive to disturbance from humans, dogs, trail-bikes and four-wheel-drives; the relative lack of such disturbance at Musselroe (other than at Lemons Beach) affords them an increasingly rare degree of protection. These same environments are also well-known foraging refugia for a large number of international migratory waders, including summer and winter visitors such as Double-banded Plover *Charadrius bicinctus* that are declining globally.

The high density of native grazing marsupials has had a significant impact in shaping the habitats and species richness of the property. For instance, high species richness among threatened species is concentrated particularly in the non-wooded but still naturally vegetated parts of the surveyed area, including marsupial lawns and the edges of lagoons and runnels, and this may be due at least partly to grazing pressure that keeps shading by perennial shrubs to a minimum. However, areas of the property east of the Little Musselroe River exhibit extremely high grazing pressure (from native marsupials), and a reduced diversity of herbaceous plants.

In conclusion, the Cape Portland property hosts a number of vascular plant, animal and lichen species that, while common or at least present on mainland Australia, in Tasmania are restricted to the northeasternmost corner of the island. Despite its long history of management for grazing, the property retains significant natural values, including high-quality patches of unusual vegetation (e.g., the almost pure stand of Southern Grasstree at Xanthorrhoea Ridge), and a high proportion of threatened plant and animal species.

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APPENDIX 1

Flora and fauna of the Musselroe Wind Farm

Taxa marked with * were observed during the survey but not collected; # were taxa recorded prior to the survey but not recorded during the survey; - were recorded prior to the survey and during the survey; i are introduced taxa in Tasmania; r, x, e and v are considered rare, extinct, endangered and vulnerable under Tasmania's Threatened Species Protection Act 1995; + are new records for Tasmania; ? are taxa that have an uncertain status, i.e., uncertain whether they are introduced to Tasmania or native.

Appendix 1.1: Vascular Plants of Musselroe Wind Farm

EUDICOTS

Aizoaceae

* *Carpobrotus rossii* (Haw.) Schwantes

*# *Disphyma crassifolium* (L.) L.Bolus subsp. *clavellatum* (Haw.) Chinnock

\- *Tetragonia implexicoma* (Miq.) Hook.f.

Amaranthaceae

\- *Hemichroa pentandra* R.Br.

\- *Rhagodia candolleana* Moq. subsp. *candolleana*

Apiaceae

\- *Apium prostratum* Labill. ex Vent. subsp. *prostratum* var. *filiforme* (A.Rich.) Kirk

Apium prostratum Labill. ex Vent. subsp. *prostratum* var. *prostratum*

\# *Daucus glochidiatus* (Labill.) Fisch., C.A.Mey. & Ave-Lall.

Eryngium vesiculosum Labill.

Xanthosia tasmanica Domin

Apocynaceae

\# *Alyxia buxifolia* R.Br.

Araliaceae

\# *Hydrocotyle callicarpa* Bunge

Hydrocotyle capillaris F.Muell. ex Klatt

\# *Hydrocotyle foveolata* H.Eichler

\# *Hydrocotyle muscosa* R.Br. ex A.Rich.

Hydrocotyle sibthorpioides Lam.

Asteraceae

Actites megalocarpus (Hook.f.) Lander

\- *Angianthus preissianus* (Steetz) Benth.

i- *Arctotheca calendula* (L.) K.Lewin

Brachyscome aculeata (Labill.) Less.

\# *Brachyscome graminea* (Labill.) F. Muell.

\- *Brachyscome parvula* Hook.f.

r# *Calocephalus lacteus* Less.

i *Carduus tenuiflorus* Curtis

Cassinia aculeata (Labill.) R.Br. subsp. *aculeata*

e# *Cassinia rugata* N.G.Walsh

\- *Chrysocephalum apiculatum* (Labill.) Steetz subsp. *apiculatum*

\- *Coronidium scorpioides* (Labill.) Paul G.Wilson

\# *Cotula australis* (Sieber ex Spreng.) Hook.f.

i- *Cotula coronopifolia* L.

r# *Cotula vulgaris* var. *australasica* J.H.Willis

\# *Craspedia glauca* (Labill.) Spreng.

\# *Craspedia rosulata* Rozefelds & A.M.Buchanan

\# *Cymbonotus preissianus* Steetz

\# *Gnaphalium indutum* Hook.f. subsp. *indutum*

i# *Hypochaeris glabra* L.

i *Hypochaeris radicata* L.

Lagenophora stipitata (Labill.) Druce

\- *Leptinella longipes* Hook.f.

Leptinella reptans (Benth.) D.G.Lloyd & C.J.Webb

Leptorhynchos squamatus (Labill.) Less. subsp. *squamatus*

\- *Leucophyta brownii* Cass.

\# *Millotia tenuifolia* Cass. var. *tenuifolia*

\- *Olearia lepidophylla* (Pers.) Benth.

\# *Ozothamnus turbinatus* DC.

Senecio glomeratus Desf. ex Poir.

r# *Siloxerus multiflorus* (Nees) P.S.Short

i *Silybum marianum* (L.) Gaertn.

i *Sonchus asper* (L.) Hill

i- *Sonchus oleraceus* L.

i *Vellereophyton dealbatum* (Thunb.) Hilliard & B.L.Burtt

Boraginaceae

\# *Cynoglossum australe* R.Br.

Hackelia suaveolens (R.Br.) Dimon & M.A.M.Renner

Brassicaceae

i *Brassica tournefortii* Gouan

i- *Cakile maritima* Scop. subsp. *maritima*

i *Capsella bursa-pastoris* (L.) Medik.

Campanulaceae

Lobelia anceps L.f.

\- *Lobelia irrigua* R.Br.

Lobelia pedunculata R.Br.

\# *Wahlenbergia gracilenta* Lothian

Wahlenbergia gymnoclada Lothian

Caryophyllaceae

i- *Cerastium glomeratum* Thuill.

i# *Cerastium semidecandrum* L.

Colobanthus apetalus (Labill.) Druce var. *apetalus*

i *Polycarpon tetraphyllum* (L.) L.

i# *Sagina maritima* Don

i# *Silene nocturna* L.

\- *Spergularia tasmanica* (Kindb.) L.G.Adams

Stellaria angustifolia Hook. subsp. *tenella* (Benth.) C.H.Mill. & J.G.West

Stellaria pallida (Dumort.) Crép.

Casuarinaceae

Allocasuarina littoralis (Salisb.) L.A.S.Johnson

\- *Allocasuarina monilifera* (L.A.S.Johnson) L.A.S.Johnson

Allocasuarina paludosa (Sieber ex Spreng.) L.A.S.Johnson

Allocasuarina verticillata (Lam.) L.A.S.Johnson

Celastraceae

Stackhousia monogyna Labill.

Chenopodiaceae

* *Sarcocornia blackiana* (Ulbr.) A.J.Scott

*# *Sarcocornia quinqueflora* (Bunge ex Ung.-Sternb.) A.J.Scott
Suaeda australis (R.Br.) Moq.
Suaeda maritima (L.) Dumort subsp. *maritima*
Tecticornia arbuscula (R.Br.) K.A.Sheph. & Paul G.Wilson

Convolvulaceae

r# *Calystegia soldanella* (L.) Roem. & Schult.
- *Convolvulus angustissimus* R.Br. subsp. *angustissimus*
r- *Cuscuta tasmanica* Engelm.
- *Dichondra repens* J.R.Forst. & G.Forst.
Wilsonia backhousei Hook.f.
r- *Wilsonia humilis* R.Br.
r *Wilsonia rotundifolia* Hook.

Crassulaceae

Crassula decumbens Thunb. var. *decumbens*
Crassula sieberiana (Schult. & Schult.f.) Druce

Dilleniaceae

Hibbertia hirticalyx Toelken
Hibbertia prostrata Hook.
Hibbertia sericea (R.Br. ex DC.) Benth. var. *sericea*

Droseraceae

- *Drosera auriculata* Backh. ex Planch.
r *Drosera glanduligera* Lehm.
Drosera hookeri R.P.Gibson, B.J.Conn & Conran
Drosera macrantha Endl. subsp. *planchonii* (Hook.f. ex Planch.) N.G.Marchant
- *Drosera peltata* Thunb.

Elaeocarpaceae

Tetratheca pilosa Labill. subsp. *pilosa*

Ericaceae

Epacris impressa Labill.
Epacris lanuginosa Labill.
Leucopogon collinus (Labill.) R.Br.
- *Leucopogon parviflorus* (Andrews) Lindl.
- *Leucopogon virgatus* (Labill.) R.Br. var. *virgatus*
- *Monotoca elliptica* (Sm.) R.Br.
Styphelia adscendens R.Br.
- *Styphelia ericoides* Sm.
Styphelia humifusa (Cav.) Pers.

Euphorbiaceae

- *Amperea xiphoclada* (Sieber ex Spreng.) Druce var. *xiphoclada*
i *Euphorbia lathyris* L.
i *Euphorbia paralias* L.
i *Euphorbia peplus* L.

Fabaceae

- *Acacia gunnii* Benth.
Acacia longifolia (Andrews) Willd. subsp. *sophorae* (Labill.) Court
Acacia melanoxylon R.Br.
Acacia myrtifolia (Sm.) Willd.
Acacia suaveolens (Sm.) Willd.
- *Acacia terminalis* (Salisb.) J.F.Macbr.
r *Acacia ulicifolia* (Salisb.) Court
- *Acacia verticillata* (L'Hér.) Willd. subsp. *ovoidea* (Benth.) Court
- *Acacia verticillata* (L'Hér.) Willd. subsp. *verticillata*
- *Aotus ericoides* (Vent.) G.Don
- *Bossiaea cinerea* R.Br.
- *Bossiaea prostrata* R.Br.
Dillwynia sericea A.Cunn.
v# *Glycine latrobeana* (Meisn.) Benth.
Hovea heterophylla A.Cunn. ex Hook.f.
Kennedia prostrata
i- *Melilotus indicus* (L.) All.
- *Platylobium triangulare* R.Br.
Pultenaea dentata Labill.
Pultenaea stricta Sims
Pultenaea tenuifolia R.Br. & Sims
i*# *Trifolium campestre* Schreb.
i *Trifolium dubium* Sibth.
i- *Trifolium repens* L.
i# *Trifolium resupinatum* L.
i- *Trifolium subterraneum* L.
i *Trifolium tomentosum* L.
i *Ulex europaeus* L.
i- *Vicia sativa* L. subsp. *nigra* (L.) Ehrh.

Gentianaceae

i- *Centaurium erythraea* Rafn
Cicendia filiformis (L.) Delarbre
r# *Schenkia australis* (R.Br.) G.Mans.
- *Sebaea albidiflora* F.Muell.
Sebaea ovata (Labill.) R.Br.

Geraniaceae

i# *Erodium botrys* (Cav.) Bertol.
i# *Erodium cicutarium* (L.) L'Hér. ex Aiton
Geranium brevicaule Hook.
i# *Geranium molle* L.
Geranium retrorsum L'Hér. ex DC.
Geranium solanderi Carolin

Goodeniaceae

Goodenia humilis R.Br.
- *Goodenia lanata* R.Br.

Haloragaceae

Gonocarpus micranthus Thunb. subsp. *micranthus*
v *Myriophyllum integrifolium* (Hook.f.) Hook.f.
r- *Myriophyllum muelleri* Sond.
Myriophyllum simulans Orchard
Myriophyllum variifolium Hook.f.

Hypericaceae

Hypericum gramineum G.Forst.

Lamiaceae

i *Marrubium vulgare* L.

Linaceae

Linum marginale A.Cunn.

Loganiaceae

Mitrasacme pilosa Labill. var. *stuartii* Hook.f.

Lythraceae

Lythrum hyssopifolia L.

Malvaceae

r- *Lasiopetalum baueri* Steetz
- *Lawrencia spicata* Hook.

Menyanthaceae

Ornduffia reniformis (R.Br.) Tippery & Les

Myrsinaceae

i *Lysimachia arvensis* (L.) U.Manns & Anderb.

Myrtaceae

Calytrix tetragona Labill.

Eucalyptus nitida Hook.f.
Eucalyptus pauciflora Sieber ex Spreng. subsp. *pauciflora*
Euryomyrtus parviflora Miq.
- *Kunzea ambigua* (Sm.) Druce
- *Leptospermum laevigatum* (Gaertn.) F.Muell.
Leptospermum scoparium J.R.Forst. & G.Forst.
- *Melaleuca ericifolia* Sm.
Melaleuca squarrosa Donn ex Sm.

Orobanchaceae
i# *Parentucellia latifolia* (L.) Caruel

Oxalidaceae
Oxalis radicosa A.Rich.
Oxalis rubens Haw.
i# *Oxalis corniculata* L. subsp. *corniculata*

Phrymaceae
- *Thyridia repens* (R.Br.) W.R.Barker & Beardsley

Phyllanthaceae
- *Poranthera microphylla* Brongn.

Pittosporaceae
Billardiera mutabilis Salisb.
- *Bursaria spinosa* Cav. subsp. *spinosa*

Plantaginaceae
- *Callitriche stagnalis* Scop.
Gratiola nana Benth.
- *Plantago bellidioides* Decne.
i- *Plantago coronopus* L. subsp. *coronopus*
Plantago hispida R.Br.
Plantago varia R.Br.
Veronica gracilis R.Br.

Polygalaceae
- *Comesperma volubile* Labill.

Polygonaceae
i- *Acetosella vulgaris* Fourr.
- *Muehlenbeckia adpressa* (Labill.) Meisn.
Rumex brownii Campd.

Portulacaceae
Calandrinia calyptrata Hook.f.
r# *Calandrinia granulifera* Benth.
- *Montia australasica* (Hook.f.) Pax & K.Hoffm.

Primulaceae
Lysimachia arvensis (L.) U.Manns & Anderb.

Proteaceae
- *Banksia marginata* Cav.
Hakea teretifolia (Salisb.) Britten subsp. *hirsuta* (Endl.) R.M.Barker
Lomatia tinctoria (Labill.) R.Br.

Ranunculaceae
- *Clematis microphylla* DC.
Ranunculus amphitrichus Colenso
Ranunculus sessiliflorus R.Br. ex DC. var. sessiliflorus
Ranunculus trichophyllus Chaix

Rhamnaceae
- *Pomaderris apetala* Labill. subsp. *apetala*
Pomaderris apetala Labill. subsp. *maritima* N.G.Walsh & Coates
Pomaderris elliptica Labill. var. *diemenica* N.G.Walsh & Coates
Pomaderris oraria F.Muell. ex Reissek subsp. *oraria*
r- *Pomaderris paniculosa* F.Muell. ex Reissek subsp. *paralia* N.G.Walsh
Pomaderris pilifera N.A.Wakef. subsp. *pilifera*
*# *Pomaderris racemosa* Hook.
r- *Spyridium vexilliferum* (Hook.) Reissek var. *vexilliferum*

Rosaceae
Acaena echinata Nees
- *Acaena novae-zelandiae* Kirk
*# *Acaena pallida* (Kirk) Allan

Rubiaceae
Asperula conferta Hook.f.
Galium australe DC.
i *Galium murale* (L.) All.
i *Sherardia arvensis* L.

Rutaceae
Boronia parviflora Sm.
Correa alba Andrews var. *alba*

Santalaceae
Leptomeria drupacea (Labill.) Druce

Scrophulariaceae
- *Myoporum insulare* R.Br.

Solanaceae
i- *Lycium ferocissimum* Miers
Solanum laciniatum Aiton

Stylidiaceae
r *Stylidium beaugleholei* J.H.Willis
Stylidium graminifolium Sw.
r# *Stylidium perpusillum* Hook.f.

Theophrastaceae
Samolus repens (J.R.Forst. & G.Forst.) Pers. var. *repens*

Thymelaeaceae
- *Pimelea glauca* R.Br.
- *Pimelea humilis* R.Br.
Pimelea linifolia Sm.
- *Pimelea serpyllifolia* R.Br. subsp. *serpyllifolia*

Urticaceae
Urtica incisa Poir.

Violaceae
Viola cleistogamoides (L.G.Adams) Seppelt
- *Viola hederacea* Labill. subsp. *hederacea*

MAGNOLIIDS

Lauraceae
- *Cassytha glabella* R.Br. f. *dispar* (Schltdl.) J.Z.Weber
Cassytha pedicellosa J.Z.Weber
Cassytha pubescens R.Br.

MONOCOTS

Asparagaceae
i* *Agave americana* L.
Arthropodium minus R.Br.
Arthropodium pendulum DC.
Chamaescilla corymbosa (R.Br.) F.Muell. ex Benth. var. *corymbosa*
- *Lomandra longifolia* Labill.
Thysanotus patersonii R.Br.

Asphodelaceae
\# *Bulbine bulbosa* (R.Br.) Haw.
\# *Bulbine glauca* (Raf.) E.M.Watson
Bulbine semibarbata (R.Br.) Haw.
Centrolepidaceae
\- *Centrolepis aristata* (R.Br.) Roem. & Schult.
\- *Centrolepis polygyna* (R.Br.) Hieron.
\- *Centrolepis strigosa* (R.Br.) Poir. subsp. *strigosa*
Colchicaceae
Burchardia umbellata R.Br.
\# *Wurmbea dioica* (R.Br.) F.Muell. subsp. *dioica*
Cyperaceae
Baumea juncea (R.Br.) Palla
Carex appressa R.Br.
\- *Carex breviculmis* R.Br.
\- *Eleocharis acuta* R.Br.
Eleocharis sphacelata R.Br.
\# *Ficinia nodosa* (Rottb.) Goetgh., Muasya & D.A.Simpson
Gahnia filum (Labill.) F.Muell.
\- *Gahnia trifida* Labill.
\# *Isolepis cernua* (Vahl) Roem. & Schult.
Isolepis hookeriana Boeckeler
?i *Isolepis levynsiana* Muasya & D.A.Simpson
\- *Isolepis marginata* (Thunb.) A.Dietr.
Isolepis platycarpa (S.T.Blake) Soják
\# *Isolepis setacea* (L.) R.Br.
\# *Isolepis subtilissima* Boeckeler
\- *Lepidosperma concavum* R.Br.
\# *Lepidosperma ensiforme* (Rodway) D.I.Morris
\# *Lepidosperma gladiatum* Labill.
Lepidosperma inops F.Muell. ex Rodway
\# *Lepidosperma laterale* R.Br.
Schoenoplectus pungens (Vahl) Palla
\# *Schoenus apogon* Roem. & Schult.
\# *Schoenus lepidosperma* (F.Muell.) K.L.Wilson subsp. *lepidosperma*
\- *Schoenus nitens* (R.Br.) Poir.
Schoenus tesquorum J.M.Black
Hemerocallidaceae
\# *Dianella brevicaulis* (Ostenf.) G.W.Carr & P.F.Horsfall
Dianella revoluta R.Br. var. *revoluta*
Hypoxidaceae
\# *Pauridia glabella* (R.Br.) Snijman & Kocyan var. *glabella*
\# *Pauridia vaginata* (Schltdl.) Snijman & Kocyan var. *vaginata*
Iridaceae
\- *Diplarrena moraea* Labill.
i- *Iris germanica* L.
\# *Patersonia fragilis* (Labill.) Asch. & Graebn.
Juncaceae
i *Juncus bufonius* L.
\# *Juncus capitatus* Weigel
**# *Juncus kraussii* Hochst. subsp. *australiensis* (Buchenau) Snogerup
Juncus sarophorus L.A.S.Johnson
\# *Luzula densiflora* (H.Nordensk.) Edgar
\# *Luzula meridionalis* H.Nordensk.
Juncaginaceae
\# *Cycnogeton alcockiae* (Aston) Mering & Kadereit
Cycnogeton procerum (R.Br.) Buchenau
r- *Triglochin minutissima* F.Muell.
\# *Triglochin nana* F.Muell.
\- *Triglochin striata* Ruiz & Pav.
Orchidaceae
\# *Caladenia latifolia* R.Br.
v# *Caladenia patersonii* R.Br.
\# *Cyrtostylis reniformis* R.Br.
r# *Cyrtostylis robusta* D.L.Jones & M.A.Clem.
\# *Diuris chryseopsis* D.L.Jones
\# *Diuris orientis* D.L.Jones
x# *Diuris palustris* Lindl.
Diuris sulphurea R.Br.
\# *Glossodia major* R.Br.
Microtis arenaria Lindl.
\# *Pterostylis curta* R.Br.
r# *Pterostylis sanguinea* D.L.Jones & M.A.Clem.
\# *Pterostylis tasmanica* D.L.Jones
v# *Pterostylis ziegeleri* D.L.Jones
x# *Thelymitra antennifera* (Lindl.) Hook.f.
\# *Thelymitra exigua* Jeanes
Poaceae
i* *Agrostis capillaris* L. var. *capillaris*
i *Aira caryophyllea* L. subsp. *caryophyllea*
i *Aira elegantissima* Schur
i *Aira praecox* L.
i* *Ammophila arenaria* (L.) Link subsp. *arenaria*
i *Anthoxanthum odoratum* L.
\- *Austrostipa flavescens* (Labill.) S.W.L.Jacobs & J.Everett
Austrostipa stipoides (Hook.f.) S.W.L.Jacobs & J.Everett
i *Bromus diandrus* Roth
i *Bromus hordeaceus* L.
i *Cynosurus echinatus* L.
\- *Distichlis distichophylla* (Labill.) Fassett
i *Holcus lanatus* L.
r# *Lachnagrostis robusta* (Vickery) S.W.L.Jacobs
i- *Lagurus ovatus* L.
i- *Parapholis incurva* (L.) C.E.Hubb.
\- *Phragmites australis* (Cav.) Trin. ex Steud.
i# *Poa annua* L.
Poa poiformis (Labill.) Druce var. poiformis
Poa rodwayi Vickery
i# *Polypogon maritimus??* var. *subspatheaceus* (Req.) Parl.
i *Polypogon monspeliensis* (L.) Desf.
Puccinellia stricta (Hook.f.) C.H.Blom
\- *Rytidosperma caespitosum* (Gaudich.) Connor & Edgar
Rytidosperma setaceum (R.Br.) Connor & Edgar
\- *Rytidosperma tenuius* (Steud.) A.Hansen & Sunding
\- *Themeda triandra* Forssk.
i# *Thinopyrum junceiforme* (Á.Löve & D.Löve) Á.Löve
i *Vulpia bromoides* (L.) Gray
i# *Vulpia myuros* (L.) C.C.Gmel. f. myuros
i# *Vulpia myuros* f. *megalura* (Nutt.) Stace & R.Cotton

- *Zoysia macrantha* Desv. subsp. *walshii* Night.

Potamogetonaceae

\# *Lepilaena cylindrocarpa* (Körn. ex Müll.Stuttg) Benth.
Potamogeton cheesemanii A.Benn.

r *Stuckenia pectinata* (L.) Börner

Restionaceae

\# *Apodasmia brownii* (Hook.f.) B.G.Briggs & L.A.S.Johnson
Empodisma minus (Hook.f.) L.A.S.Johnson & D.F.Cutler

\# *Hypolaena fastigiata* R.Br.

- *Leptocarpus tenax* (Labill.) R.Br.

Ruppiaceae

- *Ruppia polycarpa* R.Mason

Xanthorrhoeaceae

v *Xanthorrhoea arenaria* D.J.Bedford
Xanthorrhoea australis R.Br.

Zosteraceae

\# *Zostera muelleri* Irmisch ex Asch. subsp. *muelleri*

PTERIDOPHYTES

Adiantaceae

- *Adiantum aethiopicum* L.

Dennstaedtiaceae

Pteridium esculentum (G.Forst.) Cockayne subsp. *esculentum*

Dicksoniaceae

Dicksonia antarctica Labill.

Lindsaeaceae

Lindsaea linearis Sw.

Ophioglossaceae

\# *Ophioglossum lusitanicum* L.

Selaginellaceae

\# *Selaginella gracillima* (Kunze) Spring ex Salomon

Appendix 1.2: Bryophytes of Musselroe Wind Farm

MOSSES

Amblystegiaceae

Campylium polygamum (Schimp.) C.E.O.Jensen

Archidiaceae

Archidium stellatum I.G.Stone

Brachytheciaceae

Eurhynchium praelongum (Hedw.) Bruch & Schimp.
Rhynchostegium tenuifolium (Hedw.) Reichardt

Bryaceae

i *Brachymenium preissianum* (Hampe) A.Jaeger
Bryum dichotomum Hedw.
Bryum sp.
Orthodontium lineare Schwägr.
Rosulabryum capillare (Hedw.) J.R.Spence
Rosulabryum subtomentosum (Hampe) J.R.Spence

Dicranaceae

Campylopus bicolor (Müll.Hal.) Wilson
Campylopus introflexus (Hedw.) Brid.

Ditrichaceae

Ceratodon purpureus (Hedw.) Brid.

Grimmiaceae

Grimmia pulvinata (Hedw.) Hook.f. & Wilson var. *africana* (Hedw.) Hook.f. & Wilson

Hypnaceae

Hypnum cupressiforme Hedw.

Lembophyllaceae

Lembophyllum clandestinum (Hook.f. & Wilson) Lindb. ex Paris
Weymouthia cochlearifolia (Schwägr.) Dixon

Orthotrichaceae

Macrocoma tenuis (Hook. & Grev.) Vitt subsp. *tenuis*
Zygodon minutus Müll.Hal. & Hampe

Polytrichaceae

Polytrichum juniperinum Hedw.

Pottiaceae

Barbula calycina Schwägr.
Barbula crinita Schultz
Didymodon torquatus (Taylor) Catches.
Syntrichia antarctica (Hampe) R.H.Zander
Syntrichia papillosa (Wilson) Jur.
Tortella sp.
Tortula muralis Hedw.
Triquetrella papillata (Hook.f. & Wilson) Broth.
Weissia sp.

Racopilaceae

Racopilum cuspidigerum (Schwägr.) Ångstr. var. *convolutaceum* (Müll.Hal.) Zanten & Dijkstra

Sematophyllaceae

Sematophyllum homomallum (Hampe) Broth.

Thuidiaceae

Thuidiopsis furfurosa (Hook.f. & Wilson) M.Fleisch.
Thuidiopsis sparsa (Hook.f. & Wilson) Broth.

LIVERWORTS

Acrobolbaceae

Lethocolea pansa (Taylor) G.A.M.Scott & K.G.Beckm.

Aytoniaceae

Asterella drummondii (Hook.f. & Taylor) R.M.Schust. ex D.G.Long

Frullaniaceae

Frullania falciloba Taylor ex Lehm.

Geocalycaceae

Chiloscyphus semiteres (Lehm.) Lehm. & Lindenb.

Lejeuneaceae

Siphonolejeunea nudipes (Hook.f. & Taylor) Herzog

Marchantiaceae

Marchantia berteroana Lehm. & Lindenb.

Metzgeriaceae

Metzgeria furcata (L.) Dumort

Appendix 1.3: Lichens of Musselroe Wind Farm

Amandinea australasica Blaha, H.Mayrhofer & Elix
Amandinea coniops (Wahlenb.) M.Choisy ex Scheid. & H.Mayrhofer
\+ *Amandinea conranensis* Elix & P.M.McCarthy
Amandinea decedens (Nyl.) Blaha & H.Mayrhofer
Amandinea punctata (Hoffm.) Coppins & Scheid.
Anisomeridium disjunctum P.M.McCarthy & Kantvilas
Anisomeridium polypori (Ellis & Everh.) M.E.Barr
\+ *Arthothelium endoaurantiacum* Makhija & Patw.
Arthothelium ampliatum (C.Knight & Mitt.) Müll. Arg.
Austroparmelina conlabrosa (Hale) A.Crespo, Divakar & Elix
\+ *Austroparmelina corrugativa* (Kurok. & Filson) Elix & Kantvilas
Austroparmelina pseudorelicina (Jatta) A.Crespo, Divakar & Elix
\+ *Bacidia laurocerasi* (Delise ex Duby) Zahlbr.
Bacidia septosior (Nyl.) Zahlbr.
Bacidia stenospora C.Knight
Bacidia wellingtonii (Stirt.) D.J.Galloway
Bactrospora paludicola Kantvilas
Buellia aeruginosa A.Nordin, Owe-Larsson & Elix
Buellia amandineaeformis Elix & Kantvilas
Buellia dissa (Stirt.) Zahlbr.
\+ *Buellia extenuatella* Elix & Kantvilas
Buellia halonioides Elix
Buellia homophylia (C.Knight) Zahlbr.
Buellia schaereri De Not.
Buellia stellulata (Taylor) Mudd var. *stellulata*
Buellia stellulata (Taylor) Mudd var. *tasmanica* Elix & Kantvilas
Buellia suttonensis Elix & A.Knight
Caloplaca bartlettii S.Y.Kondr. & Kärnefelt
Caloplaca beaugleholei S.Y.Kondr. & Kärnefelt
Caloplaca bermaguiana S.Y.Kondr. & Kärnefelt
Caloplaca cf. *chrysodeta* (Vain. ex Räsänen) Dombr.
Caloplaca cinnabarina (Ach.) Zahlbr.
Caloplaca cranfieldii S.Y.Kondr. & Kärnefelt
Caloplaca eos S.Y.Kondr. & Kärnefelt
Caloplaca ferdinandmuelleri S.Y.Kondr. & Kärnefelt
Caloplaca gallowayi S.Y.Kondr., Kärnefelt & Filson
Caloplaca holocarpa (Hoffm.) A.E.Wade aggr.
Caloplaca cf. *irrubescens* (Nyl.) Zahlbr.
Caloplaca jackelixii S.Y.Kondr., Karnefelt & A.Thell
Caloplaca kilcundaensis S.Y.Kondr. & Karnefelt
Caloplaca lateritia (Taylor) Zahlbr.
Caloplaca maccarthyi S.Y.Kondr., Karnefelt & Elix
Caloplaca pulcherrima (Müll.Arg.) S.Y.Kondr. & Karnefelt
Caloplaca sublobulata (Nyl.) Zahlbr.
Caloplaca tomareeana S.Y.Kondr. & Karnefelt
Candelariella vitellina (Hoffm.) Müll.Arg.
Candelariella xanthostigmoides (Müll.Arg.) R.W.Rogers
Catillaria austrolittoralis Kantvilas & van den Boom
\+ *Catinaria atropurpurea* (Schaer.) Vezda & Poelt
Chrysothrix xanthina (Vain.) Kalb
Cladia aggregata (Sw.) Nyl.
Cladia inflata (F.Wilson) D.J.Galloway
Cladia retipora (Labill.) Nyl.
Cladia sullivanii (Müll.Arg.) W.Martin
Cladonia capitellata (Hook.f. & Taylor) C.Bab. var. *squamatica* A.W.Archer
Cladonia humilis (With.) J.R.Laundon var. *humilis*
Cladonia krempelhuberi (Vain.) Zahlbr.
Cladonia merochlorophaea Asahina
Cladonia neozelandica Vain. var. *striata* (A.W.Archer) Kantvilas
Cladonia ochrochlora Flörke
Cladonia praetermissa A.W.Archer var. *praetermissa*
Cliostomum griffithii (Sm.) Coppins
Coenogonium luteum (Dicks.) Kalb & Lücking
\+ *Collema crispum* (Huds.) Weber ex F.H.Wigg.
Collema glaucophthalmum Nyl. var. *glaucophthalmum*
Collema glaucophthalmum Nyl. var. *implicatum* (Nyl.) Degel.
Diploicia canescens (Dicks.) A.Massal. subsp. *canescens*
\+ *Diploschistes euganeus* (A.Massal.) J.Steiner
\+ *Diploschistes gyrophoricus* Lumbsch & Elix
\+ *Endocarpon crassisporum* P.M.McCarthy & Filson
Eugeniella farinosa P.M.McCarthy & Elix
Flavoparmelia haysomii (C.W.Dodge) Hale
Flavoparmelia rutidota (Hook.f. & Taylor) Hale
Flavoparmelia soredians (Nyl.) Hale
\+ *Gyalecta pellucida* (Coppins & Malcolm) Baloch & Lücking
Halecania subsquamosa (Müll.Arg.) van den Boom & H.Mayrhofer
Halegrapha mucronata (Stirt.) Lücking
Hertelidea pseudobotryosa R.C.Harris, Ladd & Printzen
Heterodea muelleri (Hampe) Nyl.
Heterodermia obscurata (Nyl.) Trevis.
Heterodermia tremulans (Müll.Arg.) W.L.Culb.
Hyperphyscia adglutinata(Flörke) H.Mayrhofer & Poelt
Hypotrachyna revoluta (Flörke) Hale
Japewiella pruinosula (Müll.Arg.) Kantvilas
Lecanora casuarinophila Lumbsch
Lecanora dispersa (Pers.) Sommerf.
Lecanora aff. *farinacea* Fée
Lecanora farinacea Fée
Lecanora flavopallida Stirt.
Lecanora galactiniza Nyl.
Lecanora mobergiana Lumbsch & Elix
\+ *Lecanora pseudogangaleoides* Lumbsch subsp. *pseudogangaleoides*
Lecanora saligna (Schrad.) Zahlbr.
\+ *Lecanora strobilina* (Spreng.) Kieff.
Lecanora subcoarctata (C.Knight) Hertel
Lecanora subtecta (Stirt.) Kantvilas & LaGreca
Lecanora symmicta (Ach.) Ach.
Lecanora wilsonii Müll.Arg. subsp. *wilsonii*

Lecidella granulosula (Nyl.) Knoph & Leuckert var. *granulosula*
Lecidella leptolomoides (Müll.Arg.) Elix
Lecidella sublapicida (C.Knight) Hertel
Lecidella xylogena (Müll.Arg.) Kantvilas & Elix
Leimonis erratica (Körb.) R.C.Harris & Lendemer
Lepra dactylinella (Kantvilas & Elix) A.W.Archer & Elix
Leptogium crispatellum Nyl.
Lichina intermedia (C.Bab.) M.Schultz
Maronea constans (Nyl.) Hepp
Megalaria laureri (Hepp ex Th.Fr.) Hafellner
Megalaria melaloma (C.Knight) Kantvilas
Megalaria melanotropa (Nyl.) D.J.Galloway
Menegazzia caesiopruinosa P.James
Menegazzia subpertusa P.James & D.J.Galloway
Micarea almbornii Coppins
Micarea byssacea (Th.Fr.) Czarnota, Guzow-Krzem. & Coppins
Micarea melaenida (Nyl.) Coppins
Monerolechia badia (Fr.) Kalb
Notoparmelia signifera (Nyl.) A.Crespo, Ferencova & Divakar
Ocellomma rediuntum (Hasse) Kantvilas & Gueidan
Ochrolechia africana Vain.
Ochrolechia apiculata Verseghy
Ochrolechia gyrophorica (A.W.Archer) A.W.Archer & Lumbsch
Opegrapha sp. (GK 285/18; HO 595582)
Opegrapha atra Pers.
\+ *Opegrapha niveoatra* (Borrer) J.R.Laundon
\+ *Opegrapha spodopolia* Nyl.
\+ *Opegrapha varia* Pers.
Pannaria elixii P.M.Jørg. & D.J.Galloway
Paraporpidia aff. *glauca* (Taylor) Rambold
Paraporpidia leptocarpa (C.Bab. & Mitt.) Rambold & Hertel
Parmotrema neopustulatum Kurok.
Parmotrema ochrocrinitum Elix & J.Johnst.
Parmotrema perlatum (Huds.) M.Choisy
Parmotrema reticulatum (Taylor) M.Choisy
Pertusaria crassilabra Müll.Arg.
Pertusaria lophocarpa Körb.
Pertusaria pertractata Stirt.
Physcia albata (F.Wilson) Hale
Physcia austrocaesia Elix
\+ *Physcia austrostellaris* Elix
Physcia neonubila Elix
Physcia poncinsii Hue
Placidium squamulosum (Ach.) Breuss
Porina corrugata Müll.Arg.
Porina elegantula Müll.Arg.
Porina meridionalis P.M.McCarthy
Porina rhaphidiophora (Nyl.) Müll.Arg.
Porina subargillacea Müll.Arg.
Porpidia crustulata (Ach.) Hertel & Knoph
Punctelia borreri (Sm.) Krog
Punctelia pseudocoralloidea (Gyeln.) Elix & Kantvilas
Ramalina caespitella G.N.Stevens
Ramalina canariensis J.Steiner
Ramalina celastri (Spreng.) Krog & Swinscow
Ramalina fissa (Müll.Arg.) Vain.
Ramalina inflata (Hook.f. & Taylor) Hook.f. & Taylor
Ramboldia sp. (GK 242/19)
Ramboldia blastidiata Kantvilas & Elix
Ramboldia laeta (Stirt.) Kalb, Lumbsch & Elix
Ramboldia petraeoides (Nyl. ex C.Bab. & Mitt.) Kantvilas & Elix
Ramboldia stuartii (Hampe) Kantvilas & Elix
\+ *Ramonia absconsa* (Tuck.) Vezda
Rhizocarpon geographicum (L.) DC.
Rhizocarpon reductum Th.Fr.
Rinodina asperata (Shirley) Kantvilas
Rinodina australiensis Müll.Arg.
Rinodina blastidiata Matzer & H.Mayrhofer
Rinodina oleae Bagl.
Rinodinella fertilis (Körb.) Elix var. *fertilis*
Schismatomma occultum (C.Knight & Mitt.) Zahlbr.
Teloschistes chrysophthalmus (L.) Th.Fr.
Teloschistes spinosus (Hook.f. & Taylor) J.S.Murray
Teloschistes velifer F.Wilson
Tephromela alectoronica Kalb
Tephromela atra (Huds.) Hafellner
Thelenella tasmanica H.Mayrhofer & P.M.McCarthy
Toninia aromatica (Sm.) A.Massal.
Trapelia sp. (GK 226/19)
\+ *Trapelia concentrica* Elix & P.M.McCarthy
Tylothallia verrucosa (Müll.Arg.) Kantvilas
Usnea cornuta Körb.
Usnea rubrotincta Stirt.
Usnea torulosa (Müll.Arg.) Zahlbr.
Verrucaria muralis Ach.
Xanthoparmelia australasica D.J.Galloway
Xanthoparmelia bungendorensis (Elix) Elix & J.Johnst.
Xanthoparmelia conranensis (Elix) Elix
Xanthoparmelia digitiformis (Elix & P.M.Armstr.) Filson
Xanthoparmelia elixii Filson
Xanthoparmelia filsonii Elix & J.Johnst.
Xanthoparmelia flavescentireagens (Gyeln.) D.J.Galloway
Xanthoparmelia microcephala Elix & Kantvilas
Xanthoparmelia microphyllizans Elix
Xanthoparmelia mougeotina (Nyl.) D.J.Galloway
Xanthoparmelia neotinctina (Elix) Elix & J.Johnst.
Xanthoparmelia streimannii (Elix & P.M.Armstr.) Elix & J.Johnst.
Xanthoparmelia subprolixa (Nyl. ex Kremp.) O.Blanco *et al.*
Xanthoparmelia tasmanica (Hook.f. & Taylor) Hale
Xanthoparmelia verisidiosa (Essl.) O.Blanco *et al.*
Xanthoparmelia xanthomelaena (Müll.Arg.) Hale
\+ *Xanthoparmelia xerica* (Elix) Elix
Xanthoria sp. (GK 394/18)
Xanthoria angustata S.Y.Kondr. & Karnefelt
Xanthoria coomae S.Y.Kondr. & Karnefelt
Xanthoria elixii S.Y.Kondr. & Karnefelt
Xanthoria ligulata (Körb.) P.James

Appendix 1.4: Invertebrate taxa of Musselroe Wind Farm

ARTHROPODS
ARCHAEOGNATHA
Meinertellidae
Machiloides hickmani Womersley, 1939
BLATTODEA
Blaberidae
Calolampra irrorata (Fabricius, 1775)
Blattidae
\+ Blattidae unplaced sp. TMAG_F95715
Drymaplaneta cf. *communis* Tepper, 1893
Platyzosteria biglumis (Saussure, 1864)
COLEOPTERA
Anamorphidae
\+ *Idiophyes* sp. TMAG_F98611
Anthicidae
Anthicidae unplaced sp. TMAG_F95636
Anthicidae unplaced sp. TMAG_F98784
Anthicidae unplaced sp. TMAG_F98926
Lagrioida australis Champion, 1895
Mecynotarsus leai Pic, 1942
Trichananca victoriensis Blackburn, 1891
Anthribidae
Anthribidae unplaced TFIC sp. 04
Araecerus palmaris (Pascoe, 1882)
Belidae
Pachyura australis Hope, 1834
Rhinotia bidentata (Donovan, 1805)
Stenobelus tibialis (Blackburn, 1893)
Buprestidae
Germarica lilliputana (Thomson, 1879)
Melobasis innocua Thomson, 1879
Melobasis nervosa (Boisduval, 1835)
Cantharidae
Chauliognathus lugubris (Fabricius, 1801)
Chauliognathus tricolor (Castelnau, 1840)
Heteromastix unplaced
Carabidae
Amblytelus brevis Blackburn, 1892
Bembidion proprium Blackburn, 1888
Carabidae unplaced sp. TMAG_F95840
Carabidae unplaced sp. TMAG_F97712
Carabidae unplaced sp. TMAG_F1148372
Clivina vagans Putzeys, 1866
Clivina vittata Sloane, 1896
Demetrida sp. TMAG_F98712
Hypharpax peronii (Castelnau, 1867)
Loxandrus sp. TMAG_F95857
Notonomus politulus (Chaudoir, 1865)
Philophlaeus simsoni Sloane, 1920
Prosopogmus chalybeipennis (Chaudoir, 1843)
Pseudoceneus sollicitus (Erichson, 1842)
Sarothrocrepis integra Baehr, 2018
Scaraphites rotundipennis (Dejean, 1825)
Scopodes sp. TMAG_F96081
Cerambycidae
Ancita crocogaster (Boisduval, 1835)
Ancita marginicollis (Boisduval, 1835)
Bethelium diversicorne (White, 1846)
Callidiopini unplaced sp. TMAG_F100860
Callidiopini unplaced sp. TMAG_F33390
Cerambycinae unplaced sp. TMAG_F96396
Enchoptera apicalis Saunders, 1850
Hesthesis cingulatus (Kirby, 1818)
Neissa inconspicua Pascoe, 1866
Nenenia sp. TMAG_F98558
Stenoderus suturalis (Olivier, 1795)
Uracanthus sp. TMAG_F95575
Chrysomelidae
Agetinus subcostata (Chapuis, 1874)
Aporocera viridipennis (Saunders, 1842)
Arsipoda sp. TMAG_F98512
Chaetocnema sp. TMAG_F95720
Ditropidus unplaced
Eurispa albipennis (Germar, 1848)
Geloptera jugularis (Erichson, 1842)
Geloptera sp. TMAG_F41254
Monolepta unplaced
Paropsis charybdis Stål, 1860
Paropsis porosa Erichson, 1842
Paropsisterna nobilitata (Erichson, 1842)
Paropsisterna obliterata (Erichson, 1842)
Peltoschema unplaced
+i *Psylliodes marcida* (Illiger, 1807)
Cleridae
Blackburniella intricata (Blackburn, 1891)
Eleale simplex (Newman, 1840)
Eunatalis porcata (Fabricius, 1787)
Lemidia cicatricosa Lea, 1907
Lemidia sp. TMAG_F98680
Lemidia subaenea Gorham, 1877
i? *Necrobia rufipes* (DeGeer, 1775)
Neoscrobiger sp. TMAG_F95985
Coccinellidae
Cleobora mellyi (Mulsant, 1850)
Coccinella transversalis Fabricius, 1781
i *Coccinella undecimpunctata* Linnaeus, 1758
Coccinellidae unplaced sp. TMAG_F98853
Coccinellidae unplaced TFIC sp. 22
Harmonia conformis (Boisduval, 1835)
Micraspis frenata (Erichson, 1842)
Rhyzobius hirtellus Crotch, 1874
Rhyzobius sp. TMAG_F98708
Rhyzobius pelion Tomaszewska, 2010
Rhyzobius TFIC sp. 05
Rhyzobius TFIC sp. 15
Rhyzobius TFIC sp. 35
Rhyzobius ventralis (Erichson, 1842)
Corylophidae
Holopsis unplaced
Sericoderus TFIC sp. 05
Curculionidae
Aades cultratus (Fabricius, 1775)
Aoplocnemis unplaced
Aphela algarum Pascoe, 1870
Aphela helopoides Pascoe, 1865

Cnestus pseudosolidus (Schedl, 1936)
Cryptorhynchini unplaced sp. TMAG_F95457
Cryptorhynchini unplaced sp. TMAG_F95499
Curculionidae unplaced sp. TMAG_F58817
Curculionidae unplaced sp. TMAG_F95604
Curculionidae unplaced sp. TMAG_F96050
Curculionidae unplaced sp. TMAG_F98766
Curculionidae unplaced sp. TMAG_F98811
Epamoebus ziczac Lea, 1909
Ethemaia sellata Pascoe, 1865
Gerynassa picticornis Blackburn, 1893
Gonipterus unplaced
Haplonyx casuarinae (Lea, 1909)
Leptopiini unplaced sp. TMAG_F41329
Leptopiini unplaced sp. TMAG_F95510
Leptopiini unplaced sp. TMAG_F95890
Leptopiini unplaced sp. TMAG_F96210
Leptopiini unplaced sp. TMAG_F98700
Leptopius duponti (Boisduval, 1835)
Mandalotus TFIC sp. 14
Melanterius acaciae Lea, 1899
Merimnetes oblongus (Blanchard, 1853)
Meriphus sp. TMAG_F96628
Neolaemosaccus narinus (Pascoe, 1872)
Neolaemosaccus sp. TMAG_F96154
Orthorhinus klugii Boheman, 1835
Orthorhinus TFIC sp. 02
Pelororhinus margaritaceus Erichson, 1842
Pelororhinus TFIC sp. 01
Pentamimus australis (Erichson, 1842)
Pseudotimareta subterranea (Lea, 1908)
Rhamphus acaciae Lea, 1895
Sclerorinus bubalus (Olivier, 1807)
Scotasmus litoralis (Lea, 1911)
Storeus albosignatus (Blackburn, 1890)
Storeus sp. TMAG_F98972
Tychiini unplaced TFIC sp. 18

Dermestidae
i?+*Attagenus pellio* (Linnaeus, 1758)
Trogoderma TFIC sp. 01

Dytiscidae
Antiporus sp. TMAG_F97815
Chostonectes unplaced
Exocelina australiae (Clark, 1863)
Lancetes lanceolatus (Clark, 1863)
Limbodessus gemellus (Clark, 1862)
Megaporus unplaced
Necterosoma penicillatum (Clark, 1862)
Onychohydrus scutellaris (Germar, 1848)
Platynectes unplaced
Rhantus suturalis (Macleay, 1825)
Sternopriscus tasmanicus Sharp, 1882
Sternopriscus sp. TMAG_F97431

Elateridae
Agrypnus impressicollis (Elston, 1924)
Agrypnus pictipennis (Candèze, 1857)
Agrypnus TFIC sp. 01
Conoderus erubescens (Candèze, 1859)
Conoderus fabrilis (Erichson, 1842)
Conoderus TFIC sp. 03
Conoderus TFIC sp. 11
Conoderus TFIC sp. 12
Elateridae unplaced sp. TMAG_F95495
Elateridae unplaced sp. TMAG_F98582
Elateridae unplaced sp. TMAG_F98981
Elateridae unplaced TFIC sp. 10
Elateridae unplaced TFIC sp. 32
Enischnelater specularis (Candèze, 1889)
Paracardiophorus sp. TMAG_F95158
Paracardiophorus sp. TMAG_F95439

Geotrupidae
i *Geotrupes spiniger* Marsham, 1802

Histeridae
Saprinus laetus Erichson, 1834
Teretrius sorellensis Blackburn, 1903

Hybosoridae
+ *Liparochrus* sp. TMAG_F95801

Hydraenidae
+ *Gymnochthebius* sp. TMAG_F96374

Hydrophilidae
Berosus unplaced
Cercyon sp. TMAG_F96383
Enochrus sp. TMAG_F94420
Hydrophilus latipalpus Castelnau, 1840
Limnoxenus zealandicus (Broun, 1880)
Paracymus unplaced

Hygrobiidae
Hygrobia australasiae (Clark, 1862)

Latridiidae
Cortinicara TFIC sp. 02

Leiodidae
Choleva TFIC sp. 01
Eublackburniella sp. TMAG_F41310
Leiodidae unplaced sp. TMAG_F41346
Zeadolopus unplaced

Lucanidae
Syndesus cornutus (Fabricius, 1801)

Lycidae
Xylobanus simplicicornis (Lea, 1909)

Meloidae
Palaestra cyanipennis (Pascoe, 1860)

Melyridae
Dicranolaius cinctus (Redtenbacher, 1867)
Hypattalus exilis Lea, 1909
Melyridae unplaced sp. TMAG_F98714
Melyridae unplaced sp. TMAG_F98715

Mordellidae
Glipostenoda TFIC sp. 09
Mordella promiscua Erichson, 1842
Mordellidae unplaced sp. TMAG_F98627

Nitidulidae
Epuraea meyricki (Blackburn, 1891)

Phalacridae
Austroporus melas (Lea, 1932)
Phalacridae unplaced sp. TMAG_F44443

Phycosecidae
Phycosecis litoralis Pascoe, 1875

Ptinidae
Deltocryptus sp. TMAG_F98780
Ptinidae unplaced sp. TMAG_F98630
Ptinidae unplaced sp. TMAG_F98874
Ptinus exulans Erichson, 1842
Rhipiceridae
Rhipicera femorata Kirby, 1818
Salpingidae
Orphanotrophium TFIC sp. 01
Scarabaeidae
Adoryphorus coulonii (Burmeister, 1847)
i *Aphodius lividus* (Olivier, 1789)
Aplopsis evexa (Britton, 1957)
Atenius brouni (Sharp, 1876)
Automolius depressus (Blanchard, 1850)
Cheiroplatys latipes (Guérin-Méneville, 1831)
Diphucephala colaspidoides (Gyllenhal, 1817)
Diphucephala smaragdula Boisduval, 1835
Heteronyx cervina (Boisduval, 1835)
Heteronyx pilosellus Blanchard, 1850
Heteronyx tasmanicus Blackburn, 1909
Liparetrus discipennis Guérin-Méneville, 1831
Liparetrus sericeus Macleay, 1871
Melolonthinae unplaced sp. TMAG_F95945
Melolonthinae unplaced sp. TMAG_F98770
Onthophagus fuliginosus Erichson, 1842
Onthophagus posticus Erichson, 1842
Onthophagus pronus Erichson, 1842
Onthophagus sp. TMAG_F97557
Phyllotocus macleayi Fischer, 1823
Phyllotocus rufipennis (Boisduval, 1835)
Sericesthis nigrolineata Boisduval, 1835
Scirtidae
Spilotocyphon spilotus (Blackburn, 1892)
Scraptiidae
Scraptia laticollis Champion, 1895
Silphidae
Ptomaphila lacrymosa (Schreibers, 1802)
Staphylinidae
Aleochara blackburni Bernhauer & Scheerpeltz, 1926
Aleocharinae unplaced sp. TMAG_F41202
Bledius aterrimus Fauvel, 1877
Cafius australis (L. Redtenbacher, 1868)
Cafius sabulosus Fauvel, 1877
Cafius seriatus Fauvel, 1877
Creophilus erythrocephalus (Fabricius, 1775)
Paederus cruenticollis Germar, 1848
Quedius sp. TMAG_F98639
Staphylininae unplaced sp. TMAG_F96390
Tenebrionidae
Adelium brevicorne Blessig, 1861
Adelium tenebroides Erichson, 1842
Atoichus bicolor (Blackburn, 1893)
Bassianus colydioides (Erichson, 1842)
Ecnolagria rufescens (Boisduval, 1835)
Edylius canescens Champion, 1894
Hyocis bakewelli Pascoe, 1866
Isopteron aversum (Pascoe, 1869)
Isopteron triviale (Erichson, 1842)
Meneristes australis (Boisduval, 1835)
Nocar depressiusculus (Macleay, 1872)
Pachycoelia sulcicollis Boisduval, 1835
Pemanoa tasmanica (Carter, 1915)
Pterohelaeus peltatus (Erichson, 1842)
Saragus costatus (Solier, 1848)
Sphargeris physodes Pascoe, 1860
Tenebrionidae unplaced sp. TMAG_F95884
Tetragonomenes ruficornis (Champion, 1894)
Titaena columbina Erichson, 1842
Throscidae
+ Throscidae unplaced sp. TMAG_F98854
Trogidae
Omorgus australasiae (Erichson, 1842)
Trogossitidae
Leperina decorata (Erichson, 1842)
DERMAPTERA
Anisolabididae
Euborellia brunneri (Dohrn, 1864)
Gonolabis unplaced
Labiduridae
Labidura riparia (Pallas, 1773)
DIPTERA
Acroceridae
+ *Ogcodes* sp. TMAG_F95695
Asilidae
Bathypogon nigrinus Ricardo, 1912
Cerdistus caliginosus (White, 1914)
Cerdistus flavicinctus (White, 1914)
Cerdistus vittipes (Macquart, 1847)
Leptogaster sp. TMAG_F98958
Neoaratus hercules (Wiedemann, 1828)
Neoscleropogon unplaced
Australimyzidae
Australimyza mcalpinei Brake & Mathis, 2007
Bibionidae
Dilophus unplaced
Bombyliidae
Acridophagus paganicus (White, 1916)
Aleucosia atherix (Newman, 1841)
Aleucosia calophthalma (Thomson, 1869)
Comptosia ocellata (Newman, 1841)
Exechohypopion nigricostatum (Macquart, 1850)
Exechohypopion velox (White, 1916)
Meomyia fasciculata (Macquart, 1840)
Villa fuscicostata (Macquart, 1846)
Calliphoridae
Calliphora hilli Patton, 1925
Calliphora stygia (Fabricius, 1782)
Calliphoridae unplaced sp. TMAG_F97634
Calliphorinae unplaced sp. TMAG_F99027
Onesia sp. TMAG_F98547
Canacidae
Canacidae unplaced sp. TMAG_F41340
Canacidae unplaced sp. TMAG_F41341
Chamaemyiidae
Chamaemyiidae unplaced sp. TMAG_F96118
Chironomidae
Chironomidae unplaced sp. TMAG_F41374

Chironomidae unplaced sp. TMAG_F95551
Chironomidae unplaced sp. TMAG_F96041
Chironomidae unplaced sp. TMAG_F96042

Chloropidae
Apotropina ornatipennis (Malloch, 1923)
Chloropidae unplaced sp. TMAG_F96424
Chloropidae unplaced sp. TMAG_F98232
Pemphigonotus sp. TMAG_F97691

Coelopidae
Amma blancheae McAlpine, 1991
Chaetocoelopa sydneyensis (Schiner, 1868)
Gluma musgravei McAlpine, 1991
Gluma nitida McAlpine, 1991
Rhis whitleyi McAlpine, 1991

Dolichopodidae
Dolichopodidae unplaced sp. TMAG_F41283
Dolichopodidae unplaced sp. TMAG_F41365
Dolichopodidae unplaced sp. TMAG_F115776
Dolichopodidae unplaced sp. TMAG_F97581
Heteropsilopus cingulipes (Walker, 1835)
Hydrophorinae unplaced sp. TMAG_F57575
Sciapodinae unplaced sp. TMAG_F97453

Empididae
Empididae unplaced sp. TMAG_F40378
Empididae unplaced sp. TMAG_F41210
Empididae unplaced sp. TMAG_F41274
Empididae unplaced sp. TMAG_F41359
Empididae unplaced sp. TMAG_F41360

Ephydridae
Ephydrella unplaced
+ Ephydridae unplaced sp. TMAG_F95706
Ephydridae unplaced sp. TMAG_F98245
Hydrellia tritici Coquillett, 1903
Scatella sp. TMAG_F59706

Heteromyzidae
Diplogeomyza wirthi McAlpine, 1967

Hybotidae
Hybotidae unplaced sp. TMAG_F96039

Lauxaniidae
Lauxaniidae unplaced sp. TMAG_F41248
Lauxaniidae unplaced sp. TMAG_F96423
Paranomina unicolor Hendel, 1907
Sapromyza mallochiana Evenhuis & Okadome, 1989

Limoniidae
Gynoplistia sp. TMAG_F95911
Limoniidae unplaced sp. TMAG_F96199

Lonchaeidae
Lonchaeidae unplaced sp. TMAG_F6351

Muscidae
Coenosia sp. TMAG_F47332
Helina sp. TMAG_F12791
Lispe cana (Walker, 1849)
Muscidae unplaced sp. TMAG_F41290
Muscidae unplaced sp. TMAG_F41370
Muscidae unplaced sp. TMAG_F99028

Mycetophilidae
Mycetophilidae unplaced sp. TMAG_F41206

Nemestrinidae
Trichophthalma punctata (Macquart, 1846)

Piophilidae
Piophilidae unplaced sp. TMAG_F41358

Platystomatidae
Duomyia decora (Macquart, 1846)
Lamprogaster laeta (Macquart, 1835)
Rivellia unplaced

Pyrgotidae
Cardiacera cf. *anthonyi* (Paramonov, 1958)
Cardiacera sp. TMAG_F95804

Rhinophoridae
+ *Axinia* unplaced sp. TMAG_F5984

Sarcophagidae
Oxysarcodexia varia (Walker, 1836)
Protomiltogramma laticeps Malloch, 1930
Sarcophaga sp. TMAG_F72915
Sarcophaginae unplaced sp. TMAG_F96711

Sciaridae
Sciaridae unplaced sp. TMAG_F41293
Sciaridae unplaced sp. TMAG_F96040

Sepsidae
Parapalaeosepsis plebeia (De Meijere, 1906)

Simuliidae
Simuliidae unplaced sp. TMAG_F41364

Sphaeroceridae
Thoracochaeta unplaced

Stratiomyidae
Inopus rubriceps (Macquart, 1847)
Octarthria brunnipennis (Fuller, 1934)
Odontomyia sp. TMAG_F96259

Syrphidae
Eumerus argyrogaster Ferguson, 1926
Eumerus latipes Macquart, 1846
Melangyna viridiceps (Macquart, 1847)
Orthoprosopa grisea (Walker, 1835)
Psilota coerulea Macquart, 1846
Psilota femoralis Schiner, 1868
Simosyrphus grandicornis (Macquart, 1842)
Xanthandrus agrolas (Walker, 1849)

Tabanidae
Dasybasis gentilis (Erichson, 1842)
Dasybasis neocirrus (Ricardo, 1917)
Dasybasis neolatifrons (Ferguson & Hill, 1922)
Dasybasis sp. TMAG_F46925
Dasybasis sp. TMAG_F96260
Mackerrasus microdonta (Macquart, 1847)
Scaptia auriflua (Donovan, 1805)

Tachinidae
Chaetophthalmus similis (Walker, 1853)
Microtropesa nigricornis Macquart, 1851
Polychaeta sp. TMAG_F95700
Rutilia sp. TMAG_F96000
Rutilia sp. TMAG_F97587
Rutilia sp. TMAG_F97588
Rutilia sp. TMAG_F97671
Rutilia vivipara (Fabricius, 1805)
Tachinidae unplaced sp. TMAG_F95526
Tachinidae unplaced sp. TMAG_F96034
Tachinidae unplaced sp. TMAG_F96355
Tachinidae unplaced sp. TMAG_F98551

Tachinidae unplaced sp. TMAG_F98553
Tachinidae unplaced sp. TMAG_F98650
Tachinidae unplaced sp. TMAG_F98761
Tritaxys heterocera (Macquart, 1846)

Tephritidae
Austrotephritis bushi (Hardy & Drew, 1996)
Sphenella ruficeps (Macquart, 1851)
Trupanea prolata Hardy & Drew, 1996

Therevidae
Acraspisa sp. TMAG_F95917
Acupalpa sp. TMAG_F96343
Anabarhynchus fuscoapicatus Lyneborg, 2001
Anabarhynchus maritimus Hardy, 1916
Bonjeania segnis (White, 1916)
Ectinorhynchus sp. TMAG_F47017
Evansomyia sp. TMAG_F41156

HEMIPTERA

Acanthosomatidae
Acanthosomatidae unplaced sp. TMAG_F57832
Duadicus pallidus Dallas, 1851
Elasmostethus sp. TMAG_F98349
Eupolemus sp. TMAG_F96017
Eupolemus sp. TMAG_F96098
Hiarchas sp. TMAG_F95667
Stauralia chloracantha Dallas, 1851

Achilidae
Argeleusa sp. TMAG_F57755

Alydidae
Mutusca brevicornis (Dallas, 1852)

Aradidae
Prosympiestus sp. TMAG_F98259

Callipappidae
Callipappus unplaced

Cercopidae
Bathyllus albicinctus (Erichson, 1842)

Cicadellidae
Cicadellidae unplaced sp. TMAG_F95683

Cicadidae
Diemeniana euronotiana (Kirkaldy, 1909)
Gelidea torrida (Erichson, 1842)

Coreidae
Agriopocoris unplaced
Gelonus tasmanicus (Le Guillou, 1841)

Corixidae
Diaprepocoris barycephala Kirkaldy, 1897
Sigara australis (Fieber, 1851)
Sigara neboissi Lansbury, 1970

Cydnidae
Adrisa atra (Dallas, 1851)
Adrisa sp. TMAG_F98735
Cydnidae unplaced sp. TMAG_F96412
Macroscytus sp. TMAG_F6477

Enicocephalidae
Oncylocotis tasmanicus (Westwood, 1837)

Flatidae
Siphanta cf. *hebes* (Walker, 1851)
Siphanta tasmanica Fletcher, 1985

Gelastocoridae
Nerthra sp. TMAG_F97681

Membracidae
Acanthuchus trispinifer (Fairmaire, 1846)
Ceraon tasmaniae (Fairmaire, 1846)

Micronectidae
Micronecta annae Kirkaldy, 1905
Micronecta robusta Hale, 1922

Miridae
Miridae unplaced sp. TMAG_F41263
Miridae unplaced sp. TMAG_F41342
Miridae unplaced sp. TMAG_F57255
Miridae unplaced sp. TMAG_F95673
Miridae unplaced sp. TMAG_F95825
Miridae unplaced sp. TMAG_F96013
Miridae unplaced sp. TMAG_F96014
Miridae unplaced sp. TMAG_F96106
Pseudopantilius australis (Walker, 1873)

Notonectidae
Anisops deanei Brooks, 1951
Enithares woodwardi Lansbury, 1968

Ochteridae
Ochterus unplaced

Pentatomidae
Anaxilaus vesiculosus (Herrich-Schäffer, 1840)
Buthumka sp. TMAG_F59527
Cuspicona stenuella Walker, 1868
Diaphyta rosea Bergroth, 1912
Dictyotus caenosus (Westwood, 1837)
Eribotes hobartensis Distant, 1910
Mycoolona atricornis (Westwood, 1837)
Ocirrhoe unimaculata (Westwood, 1837)
Oechalia schellenbergii (Guérin, 1831)
Omyta centrolineata (Westwood, 1837)
Oncocoris geniculatus (Dallas, 1851)
Pentatomidae unplaced sp. TMAG_F46979
Platycoris sp. TMAG_F95442

Piesmatidae
Mcateella sp. TMAG_F47683

Psyllidae
Psyllidae unplaced sp. TMAG_F103116
Psyllidae unplaced sp. TMAG_F41260
Psyllidae unplaced sp. TMAG_F41261

Pyrrhocoridae
Dindymus versicolor (Herrich-Schäffer, 1853)

Reduviidae
Coranus trabeatus Horváth, 1902
Gminatus australis (Erichson, 1842)
Nyllius asperatus Stål, 1859
Peirates fuliginosus (Erichson, 1842)
Reduviidae unplaced sp. TMAG_F96314
Reduviidae unplaced sp. TMAG_F96443

Rhyparochromidae
Brentiscerus putoni (White, 1878)
Plinthisus woodwardi Slater & Sweet, 1977
Rhyparochromidae unplaced sp. TMAG_F95961
Rhyparochromidae unplaced sp. TMAG_F98732
Rhyparochromidae unplaced sp. TMAG_F98787

HYMENOPTERA

Apidae

i *Apis mellifera* Linnaeus, 1758
Exoneura unplaced

Bethylidae

Bethylidae unplaced sp. TMAG_F96401

Braconidae

Braconidae unplaced sp. TMAG_F95810
Braconinae unplaced sp. TMAG_F95643
Braconinae unplaced sp. TMAG_F95828

Chalcididae

Chalcididae unplaced sp. TMAG_F97622
Chalcididae unplaced sp. TMAG_F97623

Chrysididae

Chrysididae unplaced sp. TMAG_F98977

Dryinidae

Dryinidae unplaced

Colletidae

Callomelitta sp. TMAG_F3998
Euhesma maculifera (Michener, 1965)
Euryglossa sp. TMAG_F96120
Leioproctus sp. TMAG_F3995
Leioproctus sp. TMAG_F95642
Leioproctus sp. TMAG_F97230
Pachyprosopis sp. TMAG_F96175
Perilampus sp. TMAG_F96179

Crabronidae

Podagritus sp. TMAG_F13427
Podagritus sp. TMAG_F95864
Tachysphex unplaced

Eucharitidae

Eucharitidae unplaced sp. TMAG_F99017

Evaniidae

Acanthinevania sp. TMAG_F100787

Formicidae

Amblyopone australis Erichson, 1842
Anonychomyrma biconvexa (Santschi, 1928)
Camponotus claripes Mayr, 1876
Camponotus consobrinus (Erichson, 1842)
Camponotus gasseri (Forel, 1894)
Camponotus hartogi Forel, 1902
Camponotus sp. TMAG_F96335
Camponotus terebrans (Lowne, 1865)
Formicidae unplaced sp. TMAG_F98752
Iridomyrmex sp. TMAG_F101247
Myrmecia forficata (Fabricius, 1787)
Myrmecia pilosula Smith, 1858
Ochetellus sp. TMAG_F98800
Pheidole unplaced
Polyrhachis patiens Santschi, 1920
Polyrhachis sp. TMAG_F7097
Polyrhachis sp. TMAG_F95827
Rhytidoponera tasmaniensis Emery, 1898

Gasteruptiidae

Gasteruptiidae unplaced sp. TMAG_F96406

Halictidae

Halictidae unplaced sp. TMAG_F4052
Halictidae unplaced sp. TMAG_F98518
Lasioglossum sp. TMAG_F4140

Ichneumonidae

Ceratomansa unplaced
Dusona sp. TMAG_F98948
Echthromorpha intricatoria (Fabricius, 1804)
Eriostethus unplaced
Habronyx sp. TMAG_F96407
Heteropelma sp. TMAG_F63139
Ichneumonidae unplaced sp. TMAG_F32289
Ichneumonidae unplaced sp. TMAG_F95586
Ichneumonidae unplaced sp. TMAG_F95829
Ichneumonidae unplaced sp. TMAG_F95868
Ichneumonidae unplaced sp. TMAG_F98739
Ichneumonidae unplaced sp. TMAG_F98944
Ichneumonidae unplaced sp. TMAG_F99011
Labena sp. TMAG_F72904
Netelia unplaced
Ophioninae unplaced sp. TMAG_F31846
Stenarella victoriae (Cameron, 1912)

Mutillidae

Odontomyrme cordatiformis Lelej, 1983

Pompilidae

Ageniellini unplaced
Cryptocheilus australis (Guérin-Méneville, 1838)
Pompilidae unplaced sp. TMAG_F59520
Pompilidae unplaced sp. TMAG_F97700
Pompilidae unplaced sp. TMAG_F98802
Pompilidae unplaced sp. TMAG_F98834
Pompilidae unplaced sp. TMAG_F98838
Pompilidae unplaced sp. TMAG_F99012
Pompilidae unplaced sp. TMAG_F99014
Psoropempula sp. TMAG_F57286
Sphictostethus sp. TMAG_F98745
Turneromyia unplaced

Sphecidae

Podalonia tydei (Le Guillou, 1841)
Prionyx unplaced

Tiphiidae

Catocheilus apterus (Olivier, 1811)
Diamma bicolor Westwood, 1835
Lophocheilus villosus Guérin-Méneville, 1842
Neozeleboria carinicollis Turner, 1915
Neozeleboria volatilis (Smith, 1859)
Rhagigaster scalae (Dalla Torre, 1897)
Thynninae unplaced sp. TMAG_F95644
Thynninae unplaced sp. TMAG_F96172
Thynninae unplaced sp. TMAG_F96405
Thynninae unplaced sp. TMAG_F97084
Thynnoides mesopleuralis Turner, 1912

Vespidae

Paralastor unplaced

LEPIDOPTERA

Anthelidae

Anthela acuta (Walker, 1855)
Anthela nicothoe (Boisduval, 1832)
Anthela ocellata (Walker, 1855)
Munychryiinae unplaced

Batrachedridae

+ *Batrachedra* sp. TMAG_F99720

Cosmopterigidae
+ *Limnaecia* sp. TMAG_F107740
Cossidae
Endoxyla lituratus (Donovan, 1805)
Crambidae
Crambidae unplaced
Crambinae unplaced
Eudonia cleodoralis (Walker, 1859)
Metasia capnochroa (Meyrick, 1884)
Ptochostola microphaeellus (Walker, 1866)
Pyraustinae unplaced
Tipanaea patulella Walker, 1863
Uresiphita ornithopteralis (Guenée, 1857)
Depressariidae
Eutorna intonsa Meyrick, 1906
Elachistidae
Chrysoclista unplaced
Elachistinae unplaced
Erebidae
Acyphas semiochrea (Herrich-Schäffer, 1855)
Erebidae unplaced
Halone sejuncta (R. Felder & Rogenhofer, 1875)
Palaeosia unplaced
Paramsacta marginata (Donovan, 1805)
Philenora sp. TMAG_F108002
Praxis edwardsii Guenée, 1852
Scoliacma unplaced
Spilosoma canescens (Butler, 1875)
+ *Thallarcha phalarota* Meyrick, 1886
Geometridae
Anachloris uncinata (Guenée, 1857)
Antasia flavicapitata (Guenée, 1857)
Capusa senilis Walker, 1857
Chloroclystis filata (Guenée, 1858)
Chlorocoma assimilis (Lucas, 1888)
Chlorocoma externa (Walker, 1861)
Chrysolarentia insulsata (Guenée, 1858)
Chrysolarentia mecynata (Guenée, 1857)
Chrysolarentia ptochopis (Turner, 1907)
Crypsiphona tasmanica Õunap & Viidalepp, 2009
Dichromodes ainaria Guenée, 1857
Dichromodes confluaria (Guenée, 1857)
Dichromodes consignata (Walker, 1861)
Dichromodes euscia Meyrick, 1890
Dichromodes longidens Prout, 1910
Dichromodes stilbiata (Guenée, 1857)
Dichromodes unplaced
Dinophalus serpentaria (Guenée, 1864)
Eccymatoge callizona (Lower, 1894)
Epyaxa agelasta (Turner, 1904)
Epyaxa subidaria (Guenée, 1857)
Gastrina cristaria Guenée, 1857
Hydriomenini unplaced *severata* (Guenée, 1857)
Idiodes apicata Guenée, 1857
Lithinini unplaced *goniota*
Melanodes anthracitaria Guenée, 1857
Microdes villosata Guenée, 1857
Nisista serrata (Walker, 1857)
Oenochroma unplaced
Oenochroma vinaria Guenée, 1857
Pasiphilodes testulata (Guenée, 1857)
Phrissogonus laticostata (Walker, 1862)
Psilosticha mactaria (Guenée, 1857)
Rhynchopsota delogramma Lower, 1903
Scioglyptis unplaced
Scopula optivata (Walker, 1861)
Scopula perlata (Walker, 1861)
Syneora mundifera (Walker, 1860)
+ *Taxeotis intermixtaria* (Walker, 1861)
Gracillariidae
Polysoma eumetalla (Meyrick, 1880)
Heliozelidae
Heliozela unplaced
Heliozelidae unplaced
Hesperiidae
Ocybadistes walkeri Heron, 1894
Lasiocampidae
Pararguda nasuta (Lewin, 1805)
Limacodidae
Doratifera pinguis (Walker, 1855)
Lycaenidae
Theclinesthes serpentatus (Herrich-Schäffer, 1869)
Noctuidae
Agrotis infusa (Boisduval, 1832)
Agrotis munda Walker, 1857
Agrotis porphyricollis Guenée, 1852
Bathytricha truncata (Walker, 1856)
Dasygaster pammacha Guenée, 1852
Ectopatria "DPILMbrownshortpecten"
Ectopatria unplaced
Hadenini unplaced species inquirenda *exarans* Lucas, 1894
Hadenini unplaced species inquirenda *ligniplena* Walker, 1857
Helicoverpa punctigera (Wallengren, 1860)
Noctuidae unplaced
Persectania ewingii (Westwood, 1839)
Proteuxoa bistrigula (Walker, 1857)
Proteuxoa melanographa (Turner, 1908)
Proteuxoa sp. nr *flexirena* (Walker, 1865)
Nolidae
Nola ANIC sp. 03
Nolidae unplaced
Notodontidae
Epicoma melanospila (Wallengren, 1860)
Psalidostetha banksiae (Lewin, 1805)
+ *Scythrophanes stenoptera* Turner, 1926
Nymphalidae
Heteronympha merope (Fabricius, 1775)
Vanessa kershawi (McCoy, 1868)
Vanessa itea (Fabricius, 1775)
Oecophoridae
Araeostoma ANIC sp. 01
Barea atmophora Turner, 1916
Barea exarcha (Meyrick, 1883)
Barea unplaced
Bida radiosella (Walker, 1863)
Oecophoridae unplaced

Oxythecta hieroglyphica Meyrick,
\+ *Philobota olympias* Meyrick, 1889
Philobota sp. TMAG_F058300
Wingia group unplaced
Pieridae
*i *Pieris rapae* (Linnaeus, 1758)
Plutellidae
Plutella xylostella (Linnaeus, 1758)
Psychidae
Psychidae unplaced
Pyralidae
Etiella behrii (Zeller, 1848)
Faveria tritalis (Walker, 1863)
Meyriccia latro (Zeller, 1873)
Phycitinae unplaced
Stericta marmorea (Warren, 1891)
Pyraloidea
Pyraloidea unplaced
Saturniidae
Opodiphthera helena (White, 1843)
Scythrididae
Scythris rhabducha Meyrick, 1897
Sphingidae
Hippotion scrofa (Boisduval, 1832)
Tineidae
\+ *Edosa* sp. TMAG_F99719
Monopis icterogastra (Zeller, 1852)
Tortricidae
Acropolitis ptychosema Turner, 1927
Acropolitis rudisana (Walker, 1863)
Cochylis cf ANIC sp. 01
Epiphyas epichorda (Meyrick, 1910)
Eucosmini unplaced
Euphona ammochroa (Lower, 1893)
Holocola unplaced
Meritastis ANIC sp. 02
Olethreutinae unplaced
\+ *Peraglyphis* sp. TMAG_F99734
Strepsicrates ejectana (Walker, 1863)
Subfurcatana unplaced
Syllomatia unplaced
Symphygas nephaula (Meyrick, 1910)
Tortricidae
Tortricidae unplaced
Xyloryctidae
Xyloryctidae unplaced

MANTODEA
Mantidae
Orthodera ministralis (Fabricius, 1775)
Tenodera australasiae (Leach, 1814)

MECOPTERA
Bittacidae
Harpobittacus australis (Klug, 1838)

NEUROPTERA
Chrysopidae
Apertochrysa edwardsi (Banks, 1940)
Chrysopidae
\+ *Mallada signatus* (Schneider, 1851)
Hemerobiidae
Micromus tasmaniae (Walker, 1860)
Mantispidae
Campion australasiae (Guérin-Méneville, 1844)

ODONATA
Lestidae
Austrolestes analis (Rambur, 1842)

ORTHOPTERA
Acrididae
\+ *Austroicetes frater* (Brancsik, 1897)
Austroicetes vulgaris (Sjöstedt, 1931)
Cirphula pyrrhocnemis (Stål, 1861)
Gastrimargus musicus (Fabricius, 1775)
Goniaea australasiae (Leach, 1814)
Macrotona australis (Walker, 1870)
e+ *Schayera baiulus* (Erichson, 1842)
\+ *Schizobothrus flavovittatus* Sjöstedt, 1921
\+ *Urnisa rugosa* de Saussure, 1884
Gryllidae
\+ *Lepidogryllus parvulus* (Walker, 1869)
Morabidae
\+ *Vandiemenella viatica* (Erichson, 1842)
Tetrigidae
Paratettix argillaceus (Erichson, 1842)
Tettigoniidae
Conocephalus bilineatus (Erichson, 1842)
Zaprochilus australis (Brullé, 1835)
Trigonidiidae
\+ *Bobilla bakali* Otte & Alexander, 1983

OTHER ARTHROPODS
ARANEAE (SPIDERS)
Araneidae
Argiope keyserlingi Karsch, 1878
Austracantha minax (Thorell, 1859)
Lycosidae
Tetralycosa oraria (L. Koch, 1876)
Salticidae
Maratus tasmanicus Otto & Hill, 2013
Sparassidae
Neosparassus diana (L. Koch, 1875)

CRUSTACEA - AMPHIPODA
Chiltoniidae
Austrochiltonia australis (Sayce, 1901)
Austrochiltonia subtenuis (Sayce, 1902)

CRUSTACEA - DECAPODA
Parastacidae
Engaeus unplaced

CRUSTACEA - ISOPODA
Scyphacidae
e+ *Haloniscus searlei* Chilton, 1920

GASTROPODA
Arionidae
*i *Arion intermedius* Normand, 1852
Charopidae
Scelidoropa officeri (Legrand, 1871)
\+ *Scelidoropa* sp. "Little Musselroe"
Scelidoropa sp. "Pioneer"

Helicidae
*i *Cornu aspersum* (Muller, 1774)
Hygromiidae
*i *Prietocella barbara* (Linneaus, 1758)
Imacidae
*i *Lehmannia nyctelia* (Bourguignat, 1861)
Punctidae
Paralaoma hobarti (Cox, 1868)
Laomavix collisi (Brazier, 1877)
Magilaoma sp. "Tasmania"
Succineidae
Austrosuccinea australis (Férussac, 1821)
Tomichiidae
Coxiella straita (Reeve, 1842)

Appendix 1.5: Vertebrate taxa of Musselroe Wind Farm

REPTILES
* *Tiliqua nigrolutea* (Quoy & Gaimard, 1824)
* *Cyclodomorphus casuarinae* (Duméril and Bibron, 1839)
* *Rankinia diemensis* Gray, 1841
* *Austrelaps superbus* (Günther, 1858)
* *Notechis scutatus* Peters, 1861

MAMMALS
* *Macropus rufogriseus* (Desmarest, 1817)
* *Macropus giganteus* Shaw, 1790
* *Thylogale billardierii* (Desmarest, 1822)
* *Vombatus ursinus* (Shaw, 1800)
*e *Sarcophilus harrisii* (Boitard, 1841)
*i *Oryctolagus cuniculus* (Linnaeus, 1758)

BIRDS
* *Acanthiza chrysorrhoa* (Quoy & Gaimard, 1830)
* *Acanthiza pusilla* (Shaw, 1790)
* *Acanthorhynchus tenuirostris* (Latham, 1801)
*i *Alauda arvensis* Linnaeus, 1758
* *Anas castanea* (Eyton, 1838)
* *Anas superciliosa* Gmelin, 1789
* *Anthochaera chrysoptera* (Latham, 1801)
* *Anthochaera paradoxa* (Daudin, 1800)
* *Anthus australis* (Gmelin, 1789)
*e *Aquila audax fleayi* Condon & Amadon, 1954
* *Arenaria interpres* (Linnaeus, 1758)
* *Artamus cyanopterus* (Latham, 1801)
* *Cacomantis flabelliformis* Latham, 1801
* *Cacomantis pallidus* (Latham, 1801)
* *Calidris ruficollis* (Pallas, 1776)
* *Calyptorhynchus funereus* (Shaw, 1794)
*i *Carduelis carduelis* (Linnaeus, 1758)
* *Cereopsis novaehollandiae* Latham, 1801
* *Charadrius ruficapillus* Temminck, 1822
* *Chroicocephalus novaehollandiae* (Stephens, 1826)
* *Chrysococcyx basalis* (Horsfield, 1821)
* *Chrysococcyx lucidus* (Gmelin, 1788)
* *Circus approximans* Peale, 1848
* *Colluricincla harmonica* (Latham, 1801)
* *Coracina novaehollandiae* Gmelin, 1789
* *Corvus tasmanicus* Mathews, 1912
* *Coturnix ypsilophora* Bosc, 1792
* *Cracticus torquatus* (Latham, 1801)
* *Cygnus atratus* (Latham, 1790)
*i *Dacelo novaeguineae* (Hermann, 1783)
* *Egretta novaehollandiae* (Latham, 1790)
* *Epthianura albifrons* (Jardine & Selby, 1828)
* *Falco berigora* Vigors & Horsfield, 1827
* *Fulica atra* Linnaeus, 1758
* *Gymnorhina tibicen* (Latham, 1801)
* *Haematopus fuliginosus* Gould, 1845
* *Haematopus longirostris* Vieillot, 1817
*v *Haliaeetus leucogaster* Gmelin, 1788
* *Hirundo neoxena* (Gould, 1842)
* *Hydroprogne caspia* (Pallas, 1770)
* *Larus pacificus* Latham, 1801
* *Malurus cyaneus* (Ellis, 1782)
* *Pachycephala pectoralis* (Latham, 1801)
* *Pelecanus conspicillatus* Temminck, 1824
* *Petroica boodang* (Lesson 1838)
* *Phalacrocorax carbo* (Linnaeus, 1758)
* *Phylidonyris novaehollandiae* (Latham, 1790)
* *Rhipidura albiscapa* Gould, 1840
* *Sericornis humilis* Gould, 1838
* *Stagonopleura bella* (Latham, 1801)
*v *Sternula nereis* (Gould, 1843)
* *Strepera fuliginosa* (Gould, 1837)
* *Strepera versicolor* (Latham, 1801)
*i *Sturnus vulgaris* Linnaeus, 1758
* *Tadorna tadornoides* (Jardine & Selby, 1828)
* *Thalasseus bergii* (Lichtenstein, 1823)
*v *Thinornis cucullatus* (Vieillot, 1818)
* *Tribonyx mortierii* du Bus de Gisignies, 1840
*i *Turdus merula* Linnaeus, 1758
* *Vanellus miles* (Boddaert, 1783)
* *Vanellus tricolor* (Vieillot, 1818)
* *Zosterops lateralis* (Latham, 1801)

SHELTERING KNOWLEDGE: RESIDENCES OF THE ROYAL SOCIETY OF TASMANIA AND ITS PRECURSORS, 1838 TO 2021

by Eric Ratcliff

(with eleven plates)

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The Royal Society of Tasmania and its precursors have met and stored their collections in at least eight different buildings in Hobart and several in Launceston since Sir John and Lady Franklin started a scientific society in 1838. Those built for the specific purpose of housing collections initiated by the societies remain as important components of the built heritage of Tasmania. The choices of style and architect made by the Royal Society for its Tasmanian Museum contributed directly to, and through influence on, the character of the historic city centre of Hobart.
Key Words: museums, libraries, botanical gardens, colonial architecture, Royal Society of Tasmania.

INTRODUCTION

The Royal Society of Tasmania (RST) founded in 1843 under the Lieutenant-Governor, Sir John Eardley-Wilmot, and gaining the royal prefix the following year when Queen Victoria agreed to become its Patron, inherited the aims and objects of several earlier associations as well as part of their collections. The Society and its precursors have met and stored their collections and libraries in at least eight different places in Hobart and four in Launceston during the past 180 years, and these buildings have contributed both directly and by influence to the built heritage of Tasmania. This paper provides a brief account of the principal sites occupied by a succession of associations dedicated to the advancement of knowledge in Tasmania.

LADY FRANKLIN'S TASMANIAN MUSEUM

In 1838, Lady Franklin wrote to her sister in London from Government House in Hobart Town: 'We are about forming a small private scientific society to meet here once a fortnight, & to have a museum' (Franklin 1838, pp. 223–225). A meeting of the society in August 1840 resolved that 'specimens illustrative of every paper read and published should be deposited in the museum, and that duplicate specimens should be sent to England'. At first, it was probably convenient to store the specimens at Government House, but it was soon realised that the safe keeping of a growing collection would require a custodian and dedicated spaces for their storage and display.

Lady Franklin had acquired a block of bushland in the foothills of Mount Wellington that she intended to keep for its natural flora and fauna. With the aid of a symposium of members of the scientific society and some classical dictionaries, she named her property *Ancanthe,* understood to mean 'vale of flowers' (Franklin 1838, pp. 223–225). Whenever she visited it, she would pass the scene described by her stepdaughter, Eleanor Franklin: 'a wooden cottage with some pillars in front, which is a very pretty object from the road, having the Mountains in the background' (Franklin 1842, p. 196). In 1838, Lady Franklin 'out of her private income' purchased the ten-acre block that included the cottage and asked the botanist Ronald Campbell Gunn to establish there 'a Collection of our indigenous Plants – a thing most urgently wanted' (Gunn letter to Sir William Hooker 15 February 1838 in Burns & Skemp 1961, p. 71). Lady Franklin decided that as the government under her husband, Sir John Franklin, was not in a position to provide a museum, she would build her own there.

The choice of a Grecian design appears to have had multiple origins. It may be that a feature of the cottage, probably the one shown near the museum in both John Skinner Prout's and Loetitia Casey's wash drawings of about 1843, contributed a suggestion towards the style of the museum (Casey 1843, Prout 1844). The property had been given a Greek name, and the proposed museum was also spoken of as a *glyptothek.* Strictly, that word embodies the combining form denoting carving or engraving on gemstones, so its original meaning was closer to a jewel-box than a building, but by extension, it came to mean a repository for carvings, a keeping place for sculptures (*Webster's Dictionary* 1948: *glyptotheca*). As part of Lady Franklin's plan to uplift the cultural life of the colony, it was intended that the museum should contain not only specimens from the natural world, but also works of art, including a selection of casts from the 'Elgin Marbles'. There is no evidence that the casts ever arrived in this colony, although the University of Sydney did acquire some at an early time in its history.

The phase of Neoclassicism in England now known as the Greek Revival was at its height when young Jane

Griffin became involved in the cultural life of London. The building of the British Museum designed by Sir Robert Smirke, a *chef d'oeuvre* of Grecian style, had begun in 1825, and she would have been very much aware of the Elgin Marbles and probably went to see them either in Lord Elgin's shed, where they had been made accessible to artists and cognoscenti at least since 1811, or, after they had been purchased for the nation at one of their subsequent locations, before her departure for Van Diemen's Land as Lady Franklin in 1837.

She had a lively interest in architecture, and, judging from a shopping list of books she sought from her sister in London in 1840, her tastes embraced the smorgasbord of fashions available in the stylistic period now known as the Regency (Franklin 1840). The Franklins showed no particular preference for one style over another; Sir John's projected secondary college at New Norfolk was intended to be Grecian, but the new Government House was begun in 1842 to a Tudor Gothic design devised by the former convict architect, James Blackburn (Blackburn 1840).

It seems clear, however, that Lady Franklin wanted a Neoclassical museum, for in 1841 she wrote to her sister asking her to obtain a design from Sir Francis Chantrey (Franklin 1841), the celebrated portrait sculptor whose habit was to render his sitters in Roman garb. Anything he recommended was going to be either Grecian or Roman. It is not known whether the requested design was sent, or whether Lady Franklin was forced to rely entirely on the architectural resources of the colony, which were not inconsiderable. John Lee Archer had been retrenched from the position of Colonial Architect and Engineer by Sir John in 1838, and her nephew, William Porden Kay, did not arrive to take up a recreated position until 1843, but the government drawing office was still manned, mostly by former convicts. Pre-eminent among these was James Blackburn, and it was to him that she turned to build her museum, although, despite his proven abilities, she strongly disapproved of him socially. She found fault with him at least once in the course of the work; she noticed that the pediment was leaning a little, and he is reported to have vowed that she must have climbed on to the roof to discover the error (Woodward 1951).

A simple *tempietto* design to be realised in sandstone was well within Blackburn's capabilities, without assistance from an imported pattern. He was a trained architect and engineer from London who had been convicted of forgery in 1833 and transported for life. In May 1841 he gained a free pardon for his expert services in the Department of Roads and Bridges and the later Department of Public Works. At the time of Lady Franklin's commission, he was nearing the end of his time in government employ and engaged in adding a manneristic Doric *porte-cochère* to the Treasury building in Murray Street. However, the design for that was publicly criticised as being excessive, so it was reduced to a porch (*The Courier* 4 March 1842, p. 3). The late Geoffrey Stilwell speculated that the extra columns thus made redundant may have been used at *Ancanthe* (Stilwell 1971), but that is unlikely to be the case as they were entirely different in dimensions.

The building, comparable in scale to the smaller garden temples built in England since the mid-eighteenth century, is in the form of a prostyle temple, with a portico with four fully detailed Doric columns supporting a simplified entablature and a plain triangular pediment without acroteria (pl. 1). Behind this, the side walls are without windows, but articulated with attenuated antae, piers of Grecian derivation designed to harmonise with columns, but not to imitate them. The interior consists of a gallery, illuminated by skylights, and two small back rooms behind a chimney with an elegant black marble chimney-piece. In his endeavour to give the building the external appearance of a Greek temple, Blackburn created some problems. The pitch of the roof is at an angle of 17°, considerably steeper than that of ancient Greek temples, but about half as steep as the average colonial roof, and impracticably shallow for effective weatherproofing from the covering of split shingles that it originally wore, a problem further exacerbated by the necessary skylights. Consequently, the original ceiling inside has had to be replaced. The chimney-stack was built as low as possible so that it would not be visible from the front, and the fireplace is likely to have smoked profusely.

The frontal columns lack entasis, the slight bulge along the length of the shafts introduced to avoid the optical illusion of concavity, but otherwise they are archaeologically correct in detail, proportion and spacing. The entablature is properly divided into lintel and frieze, but there is no decorative apparatus of triglyphs alternating with metopes in the latter, nor guttae above the former. The most evident non-Grecian feature is the articulation of the walls; in an ancient Greek prostyle temple, antae appear only ahead of the side walls, under the portico, but centuries of Georgian design founded on Roman and Renaissance precedent had made architects incapable of providing a plain ashlar-faced wall without dividing or decorating it in some way.

The building of the Tasmanian museum was well under way by March 1842 and it opened in October of the following year a few weeks before the Franklins left the colony (Boyes 1843, Craig 1961). With their departure impending, they were not confident of the survival of the Tasmanian Society, as their scientific society was now called, so Lady Franklin deeded the *Ancanthe* estate to five trustees: Bishop F.R. Nixon (the first bishop of Tasmania), J.E. Bicheno (the Colonial Secretary), Reverend T.J. Ewing, Reverend J.P. Gell, and the botanist, Ronald Campbell Gunn (Burns & Skemp 1961, p. 72). Hence, the property came into the hands of the Church of England, and in view of its educational intention, was entrusted to Christ College in its first foundation. When the College closed at the end of 1856, the property entered a period of neglect. Some of the collections had been acquired by the RST, and in 1853 the glass cases made to display them were purchased from the trustees of Christ College to use in its new Tasmanian Museum. Some eventually found their way to Launceston, where at least one may still be in use (Piesse 1913, p. 153).

Apart from the architect's drawings, which no longer seem to exist, the earliest image of the museum is probably the etching by Thomas Bock on the souvenir card for the

PLATE 1 – Lady Franklin's Tasmanian Museum, Kangaroo Valley, Hobart, circa 1910 in the form of a prostyle temple, with a portico with four fully detailed Doric columns supporting a simplified entablature and a plain triangular pediment without acroteria. Photo ID: 144585718. Hobart Lenah Valley: collection of postcards by W.J. Little. Libraries Tasmania's Online collection, https://stors.tas.gov.au/AUTAS0016125397091

laying of its foundation stone on 16 March 1842 (pl. 2). A letter from Lady Franklin to Captain Ross dated 3 April 1843 made it clear that the card was to be given 'to all present' at the laying of the stone, so it does not appear to be a ticket of admission for the opening day as sometimes stated (Owen 1978). In the same letter, Lady Franklin states that 'I have since had it engraved', but that subsequent image has not been located. The etching is accurate in detail, but slightly increased in vertical scale, and there are three steps forming the crepidoma at the front, and not the six that are still there. The engraving must have been derived from Blackburn's elevation drawing, as it pre-dates the laying of the stone.

If Sir John Franklin's daughter had found the setting picturesque before the museum was built, other artists found it even more so after the little temple appeared in its rough bushland setting. Loetitia Casey made a watercolour drawing of it possibly soon after its completion, from a viewpoint similar to that used by John Skinner Prout in 1844 (Casey 1843, Prout 1844). The two images show the land cleared in front of the building, but no trace of a garden. The Franklins had left Van Diemen's Land in 1843, with the botanist Ronald Campbell Gunn acting as agent for Lady Franklin who continued to own a number of colonial properties other than *Ancanthe,* some at least until 1864 (Burns & Skemp 1961, p. 98). Both images follow the Picturesque fashion of framing the scene with foreground vegetation, and both show the earlier cottage on *Lower Ancanthe* with its four veranda columns on the front. Casey's drawing is less competent but more atmospheric, Prout's more detailed and accurate, and although they appear so similar, even to a fallen tree-trunk spanning the stream in the foreground, one does not appear to be a copy of the other. In both pictures, the museum looks lenely; its presiding genius had departed.

The little temple lost in the bush attracted the attention of many artists in the ensuing century, even before it was leased to the Art Society of Tasmania in 1948. Either before her move to England in 1888 or after her return in 1922, Lily Allport produced a more lateral view, unusually revealing the long, low chimney stack towards the back in her gardenesque image (Allport undated).

From its simple form, and its multiple associations with Ancient Greece and with the garden temples of 'Augustan' England, the museum was an object in its own right, a focus of the Picturesque. It is difficult to imagine its successors giving rise to so many images.

The building was used for a time as a farm building, at one stage an apple-shed, at another attached to a slaughterhouse. An old photograph shows the building intact, but with a wooden skillion annexed (pl. 3). During its years of eclipse, it was idealised in a famous drawing by the Sydney architect and artist, William Hardy Wilson, reproduced in his *Old Colonial Architecture in New South Wales and Tasmania* (Hardy Wilson 1924). His romantic rendering donated a pair of urns under the portico and a selection of antique ruins in the foreground, and corrected the architecture by giving the columns the subtle entasis that they lack, but otherwise it is an accurate image. The tiny, remote, neglected, antipodean building is presented as a *chef-d'ouvre* of Neoclassicism of a variety at that time yet to be recognised as 'Greek Revival'.

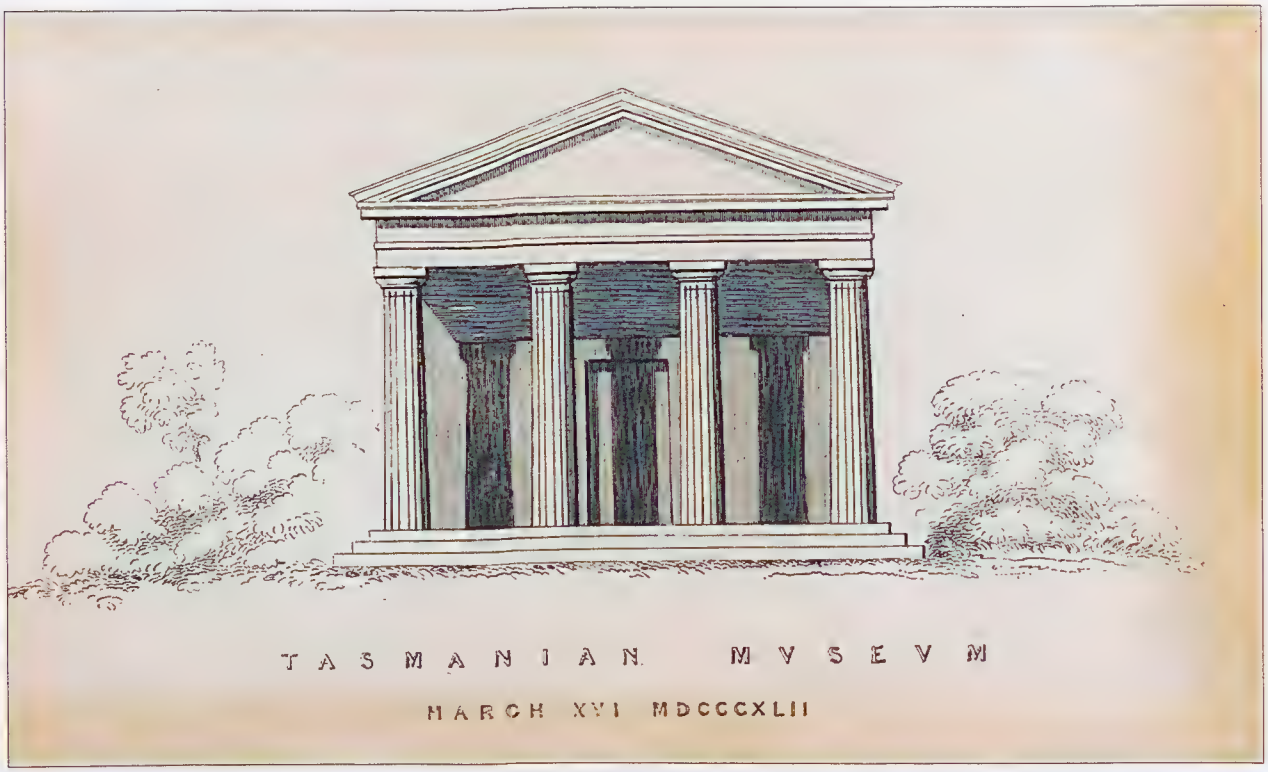

PLATE 2 – Card with engraving by Thomas Bock, given to guests at the laying of the foundation stone of Lady Franklin's *Tasmanian Museum* on 16 March 1842. (Image from Franklin, Jane 1843, *Letter from Lady Franklin to George Washington Walker 25th Oct. 1843 and card with engraving of Ancanthe by Thomas Bock.* University of Tasmania Library Special and Rare Materials Collection, Australia. Open Access Repository, W9/A1/11

An Act of Parliament in 1926 awarded the property to the Hobart City Council and it was later named *Ancanthe Park*. The museum has been leased to the Art Society of Tasmania since 1948 and continues to serve at least one of its historic purposes.

It can be argued that, at *Ancanthe*, Lady Franklin planted seeds that grew into two important institutions that owe their fruition to the Royal Society of Tasmania: the Tasmanian Museum and Art Gallery and the Royal Tasmanian Botanical Gardens. In the latter case, her contribution was in the preservation of native flora rather than the exotics that at that time were being acclimatised in the government garden.

HORTICULTURAL INTERLUDE

Lady Franklin's botanical garden at *Ancanthe* did not long outlast her departure, but there was already a government garden near Pavilion Point on the shoreline of the Government Domain, originally set aside for the purpose by Lieutenant-Governor William Sorell in 1818 and developed from 1827 on the orders of his successor, George Arthur. The Governor thought that the climate might require a garden wall heated by flues for the cultivation of fruit as in England; the result, now known as the Arthur Wall, and the Gothick-styled *cottage orné* for the Superintendent of the government garden were both built in 1829 (Hurburgh 1986) (pl. 4A).

In 1843, as an economy measure, Lieutenant-Governor Eardley-Wilmot proposed placing the garden under the management of a newly created Botanical and Horticultural Society of Van Diemen's Land, supported by a diminished government subsidy. This took effect on the first day of 1844, and in September of that year, the Governor announced that the Queen had consented to be Patron; the name of the custodial body became 'The Royal Society of Van Diemen's Land for Horticulture, Botany and the Advancement of Science' (Piesse 1913, Hurburgh 1986, p. 17). Four years later, under Sir William Denison, the Tasmanian Society begun by the Franklins was amalgamated with the more recent foundation, and in 1911 an Act of Parliament formalised the name of the body to be The Royal Society of Tasmania (*Royal Society Act 1911*, https://www.legislation.tas.gov.au/view/whole/html/inforce/2017-10-16/act-1911-047).

FROM THE BOTANICAL GARDENS TO HARRINGTON STREET

In his attempt to unravel the machinations surrounding the formation of the RST, its early historian, E.L. Piesse, asserted that the Botanical Gardens placed in its care by Sir Eardley Eardley-Wilmot 'absorbed all the energy of the Society' for its first four years, and implied that its meetings were held in the Superintendent's Cottage (Piesse 1913, p. 7 and plate XIV).

Reproduced by courtesy of the Tasmanian State Library.

10 Lady Franklin's Ancanthe: 'the glory of the time before' (see p. 146).

PLATE 3 – An undated image by an unidentified photographer of Lady Franklin's Museum as a farm building, c. 1900. Photo: Libraries Tasmania collection

In 1845, the RST commissioned the building of another cottage within the Gardens to house their Secretary; it consisted of two rooms and a kitchen (Royal Society Tasmania 1845). This first building for the RST was designed by the Colonial Architect, William Porden Kay, and was given some style in recognition of its prominent position in a garden intended to be ornamental as well as scientific. It cost £126 to build; the Lieutenant-Governor agreed to supply the stone from the government quarry free-of-charge but required the RST to make good any damage to the road resulting from the carting of it (Hurburgh 1986, pp. 21–23). Recently restored, the building still stands near the end of the Arthur Wall and the main entrance gates.

The annual report presented in February 1846 contained a proposal to fit out the cottage as a 'museum and reading room', but this was not proceeded with (Piesse 1913, p. 145). A photograph of the unaltered cottage shows it was obviously too small for such a conversion without very substantial additions (pl. 4B).

From about the time when the activities of the earlier Tasmanian Society faded from view, the RST began to meet and house its collections in rooms pertaining to the Legislative Council at Parliament House. The building had been designed in 1835 in the office of the Colonial Architect, John Lee Archer, as a new Custom House (Tasmanian Archives CSO/804/17189). The design is attributed to Archer, because he was in charge and signed the plans, but a parliamentary history identifies an elusive assistant named McNeilly (Smith 1962, McKay & Pickup 1973). The Customs Department was to occupy the centrepiece and the south wing, and the north wing towards Murray Street was intended for other government offices, principally that of the Colonial Architect and Engineer, who was to be provided with drawing offices and an 'architectural library and model room' (Tasmanian Archives CSO/804/17189). Archer was retrenched and his position for the time being abolished in 1838, before the completion of the building. In 1840, the Legislative Council took up residence in the Long Room of the Custom House, the beginning of its history as the Tasmanian Parliament House.

The room used by the RST from 1848 to 1852 was the 'large committee room of the Legislative Council', probably the one that had been Archer's intended library and model room (Piesse 1913, p. 153).

The need of both Parliament and the RST for more space led to a search for new premises, and from 1852 the RST leased a mansion at No. 167 Macquarie Street. This was one of a handsome pair of sandstone-faced houses occupying the south-western corner of the intersection of Macquarie and Harrington Streets (Piesse 1913, p. 155). They had been designed in 1847 by Alexander Dawson, an architect employed in the Public Works Department, and their early Victorian style, advanced for its time and unique in the colony, probably reflected his experience in Glasgow, Scotland. His other notable buildings in Tasmania include the former Hobart Town High School, now *Domain House* of the University of Tasmania, the monumental column of the 99th Regiment in Anglesea

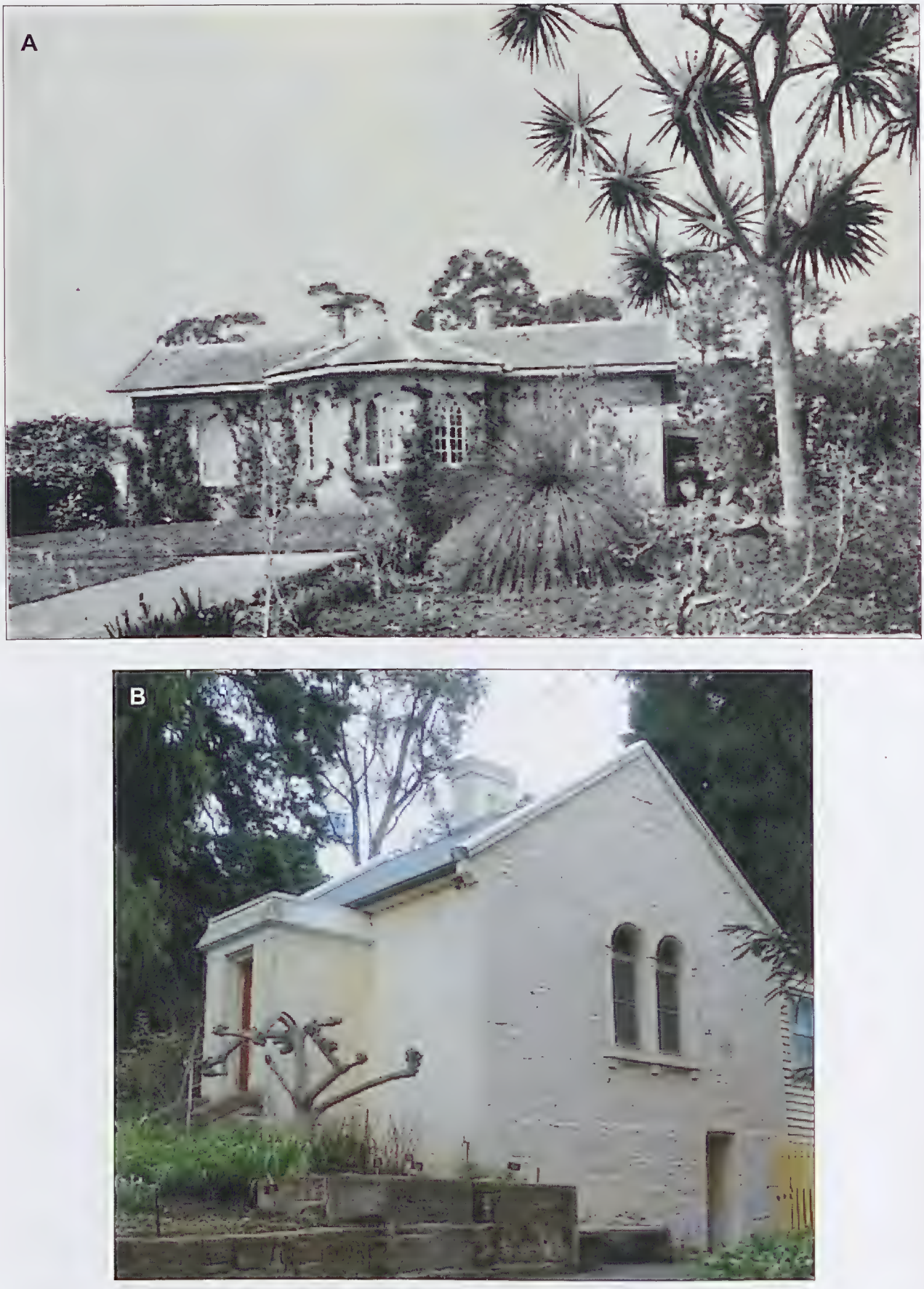

PLATE 4 – **A**. The Regency Gothick cottage built for the Superintendent of the Government Garden in 1829 (Plate XIV from Piesse 1913). **B.** The first building commissioned by the Royal Society of Tasmania, a cottage in the Botanical Gardens built in 1845, designed by the Colonial Architect, William Porden Kay with windows in a Williamane Italianate style. It was restored in 1998 and is now called the Friends' Cottage.

Barracks, *Mayfield* in Stoke Street, New Town, *Cananore* in Davey Street, almost certainly *Cawarra* on Risdon Road, and the former St Mary's Hospital at the corner of Davey Street and Salamanca Place. He was to become Colonial Architect in New South Wales, where he designed *inter alia* the Supreme Court Registry and the Observatory in Sydney.

The two houses had been built for the Battery Point shipbuilder George Watson, and the corner house (No. 167 Macquarie Street, but with an imposing entrance on Harrington Street, and later named *Conara*) (pl. 5) had been specifically designed for the residence and school of the owner's son-in-law, Philip Canaway, who opened his 'Tasmanian Academy' there in 1848 (*The Courier* 12 Feb. 1848, p. 2). The adjoining house on Macquarie Street (No. 169, later named *Lalla Rookh*) was where Trukanini (Truganini) lived for nearly two years in the care of the Dandridges, and where she died in 1876. The name of the house was that of the eponymous heroine of Thomas Moore's long poem published in 1817, and had been one of the nicknames, intended to be complimentary, imposed on Trukanini during her lifetime.

Mr Canaway's schoolroom was described in the *Hobart Town Courier* as 'the handsomest room in town', but his Academy was short-lived (*The Courier* 29 March 1848, p. 2). The RST occupied the house less than four years later, and in 1853, purchased from the trustees of Christ College the glass cases and other fittings from Lady Franklin's Museum (Piesse 1913, p. 156). When these had been installed in the handsomest room in town, the Society's museum was opened to the public for the first time (Piesse 1913, p. 156). There, the museum was visited by Captain Butler Stoney, paymaster of the 99th Regiment of Foot, stationed at Anglesea Barracks, who informed his British readers that it was 'much too small for its increasing collections in natural history and the liberal donations of curiosities which it is constantly receiving', but he regarded it as 'well worthy of a visit from the stranger' (Stoney 1856, pp. 108–109).

Now that their museum was open freely to the public, the RST felt justified in seeking assistance from the Colonial Government to enable it to house its collections, library and its meetings in permanent quarters designed for the purpose. The Tasmanian Government offered to grant the open space of Fitzroy Crescent for a museum and a projected zoo, but nothing eventuated. Other sites were considered, including part of the old gaol site in Murray Street where the Hobart Savings Bank, the first Masonic Hall, and the Derwent and Tamar insurance office were later built, then part of the former Government House grounds, now occupied by the Town Hall, an extension of Elizabeth Street, and Franklin Square. Finally, in 1860, the opposite corner of Macquarie and Argyle streets was given to the RST, and planning soon began on a new Tasmanian Museum, library and meeting room (Piesse 1913, p. 156).

Regrettably, town mansions that did not stand in their own grounds fell out of fashion, and although long used for professional rooms, *Conara* and *Lalla Rookh* fell on relatively hard times. Despite their architectural importance, prominence and great historical interest, and protests from

PLATE 5 – Watercolour by an unknown artist [possibly the architect] of two town houses in Macquarie Street designed by Alexander Dawson and built in 1847. The brown-coloured opening in the painting was an archway giving access to the tradesmen's entrances to both houses. The Society occupied the house on the corner of Harrington Street with an entrance on both façades, later known as *Conara*. Painting donated by Dora Hookey, RST artwork collection

the National Trust, *The Mercury* and opposition within the Hobart City Council, they were demolished in 1965 to give place to one of the least attractive architectural products of that decade, the Four Seasons Hotel, later the Macquarie Motor Inn (Young 1998). Perhaps in the emotional climate of the time, a darker history was against them.

THE TASMANIAN MUSEUM AND ART GALLERY

Having been granted a prominent site for their new building, the RST decided in 1860 to hold an architectural competition for its design. As was usual in the nineteenth century, the entries for the competition were required to be anonymous, although we might wonder how incognito the entrants could have been in the small pool of the Tasmanian and indeed the Australasian architectural profession, even with the addition of enthusiastic amateurs. The premium offered for the winning entry was £30. The successful entrant signed himself as 'Nimrod', and the biblically literate members of the judging panel would have had no difficulty in unmasking the young Henry Hunter.

His entry was in a style described as Italian Renaissance and provided for a two-storey building containing four galleries one above another in each of two wings, a library, a meeting room and offices (pl. 6). The design allowed for the building of two galleries in a first stage, the others to be added when possible. The RST called for tenders to build the first stage, and eight were received (Ward 2006, p. 42).

On 6 August 1861, James Agnew, Morton Allport, Alfred Kennerley, Thomas Giblin, Archdeacon Davies and Dr Edward Bedford on behalf of the RST signed a contract with Seabrook and Son to construct the building for £3772 (Piesse 1913, p. 160, Ward 2006) A building fund attracted 141 subscribers, and the government contributed a substantial sum. Knowledgeable sources are at variance about the proportions of the contributions from the members and the government. Ward states that the government provided one third (Ward 2006, p. 44), while Piesse states that the government 'added £3,000' towards a total cost of 'about £4,800' (Piesse 1913, p. 160). A small additional contract was negotiated to provide six fitted display cases for £35 each and four 'flat' display cases for £11 each (Ward 2006, p. 44). The RST first met in the building on 29 January 1863 (Piesse 1913, p. 160), but its opening to the public awaited rearrangement of the collections.

The *palazzo*-styled building addresses the corner handsomely with three bays on each façade, harmonious but not identical; the plainer side-lighted galleries of seven bays parallel to Macquarie Street are recessed from the street. The public façades are faced with sandstone of two colours; the paler quoins, arches, cornices, parapets and false porch are of stone from Mornington Hill above Bellerive, and the yellower stone of the main wall surfaces came from the Waterworks quarries.

The entrance on Argyle Street was placed in a break front that clearly showed the intention to extend the building on

PLATE 6 – Henry Hunter, 'Front in Argyle Street', detail from 'Portion of Royal Society's intended Museum to be built at the corner of Macquarie and Argyle streets', ink, wash and pencil on paper. Note the false perspective created by placing pilasters behind the engaged columns and paralleling the entablature of the false porch. Image: Tasmanian Museum and Art Gallery R1993.3.912

that side, and the end wall where the addition would have to be made was politely finished and detailed in render in the expectation that there would be a long wait (pl. 7).

The style chosen for the building has been held to have had a direct influence on that of the Hobart Town Hall. Peter Bolger asserted that the influence was in the opposite direction (Bolger 1973), but Barrie Shelton's dating of the respective drawings by Hunter makes the priority clear (Shelton *et al.* 1982). The Municipal Council had announced a competition for the design in 1861, and the winning entrant was Henry Bastow whose design, now lost, is believed to have been in a Gothic style, with an Italianate design by Frederick Thomas placed second. Henry Hunter, strongly under the influence of the Roman Catholic Bishop of Hobart, Robert Willson and the Bishop's friend Augustus Pugin, and currently supervising the building of a very Puginian Church of England (All Saints in South Hobart), had entered a project in a Gothic style. According to Barry Shelton, the press and the Aldermen found a Gothic style unacceptable (Shelton 1982). Peter Freeman has discovered that the Council had a mysterious change of mind (Freeman 2016) and this may be explained by the government requiring that as a condition of the grant of land, the style must be compatible with that of the Supreme Court building, then under construction in Macquarie Street to a polite Franco-Italianate design attributed to William Porden Kay, with Frederick Thomas supervising. Whatever the reason for the decision, the museum under construction across the street provided an excellent sample, so in 1862 Hunter was commissioned to provide a design in a similar style. Hunter gave the RST an elegant box, a receptacle, a keeping place with allusions to Renaissance and Enlightenment and not to medieval obscurantism. The RST choice may have contributed to preventing the gothicisation of an important part of the city. If that had eventuated, it might not have weathered the changes of taste that came with the twentieth century as well as did Hunter's *palazzo* Italianate.

In December 1885, an Act of the Tasmanian Parliament provided that the Society's Museum and Botanical Gardens should be vested in a Board of Trustees, and 'endowed out of the Public Funds', and that:

> *in consideration of the services provided by the Society in the promotion of science and in the formation, management, and guardianship of the Museum [...], the Society shall have exclusive possession of the Library Room of the Museum, or other sufficient or convenient rooms therein, for the safe custody of their library books and other effects, and for their meetings and for all other purposes connected with the Society.*
> (Parliament 1885, clause 4, p. 198)

The Act enabled the realisation of Henry Hunter's plans for additions on the Argyle Street side, to provide two more galleries and a basement for storage. The new wing was begun in 1886 under a government contract with the builder William Cheverton with Hunter supervising, but the architect moved to Brisbane in the following year. The contract price was £2550 and the building was completed in 1889, with a façade resembling that on the Macquarie Street galleries (Hunter 1886). Interestingly, although

PLATE 7 – Dr James Agnew laying the foundation stone for the new wing on Argyle Street, 23 December 1886, anonymous photographer, albumen print. Note the rendered detail of the temporary end wall of the original building. Photo: Tasmanian Museum and Art Gallery Q1073

Hunter was working in a style that usually demanded symmetry on the main front, his Gothic experience enable him to compose his Italianate elevations asymmetrically but harmoniously, and few now notice the differences in length and detail on either side of the original entrance.

In 1901, an addition to the end of the Macquarie Street wing, designed by Orlando Baker in the Public Works drawing office, included a top-lit gallery on the upper floor and another gallery on the lower floor that from 1930 became the library and meeting room for the RST. There, the library remained until placed in the care of the University, and there the RST met until it moved into part of the former Custom House on Davey Street opposite the docks, designed by Orlando Baker in 1899 (copies of the drawings held in the National Archives of Australia are displayed within the building, pl.8). That building had been commissioned by the Tasmanian Government on the verge of Federation, and brought forth on a grand scale in the justified expectation that the new Commonwealth would pick up the tab when it was completed in the new century. The building became largely redundant in the late twentieth century, and in 2004 the State Government acquired it from the Commonwealth and annexed it to the Museum and Art Gallery.

So, the RST that had firmly established itself while a tenant in one Custom House, continues to thrive in another, although its quarters, convenient as they are, can no longer be regarded as 'sufficient' as promised in the 1885 Act.

In 1969, the RST library was moved to the Morris Miller Library in the University of Tasmania at Sandy Bay, designed by John Scarborough of Melbourne and built in 1968 as part of a complex of buildings that are architecturally undistinguished.

BEYOND THE CAPITAL

A Northern Branch of the RST was formed in 1853 and met first at the Launceston Public Buildings and then at the Launceston Mechanics' Institute (Ross 2021, pl. 9), both designed by William Henry Clayton, a Tasmanian who became the sole Colonial Architect of New Zealand. The start of a museum collection was first stored at these successive venues, and first displayed at the latter (Petrow 1998) (pl. 10). The Branch had lapsed by 1878 but was decisively re-founded in 1921. Its meetings took place in the 'classroom' of the Launceston Public Library, the former Mechanics' Institute, then in the hands of the Launceston City Council. The classroom was within the library annexe added in 1907 to Clayton's original Mechanics' Institute building on the corner of St John and Paterson streets. The site of those buildings is now occupied by the part of the Civic Square between St John Street and the Launceston Library.

In 1883, the Mayor of Launceston, Alderman Samuel Sutton, called a public meeting to consider his proposal for an 'industrial exhibition' to be held in Launceston. A grant-in-aid was sought, but Parliament refused it by a narrow majority. In 1885, the Municipal Council in Launceston held a plebiscite, as a result of which £4500 was set aside for the building of a permanent public hall as part of the exhibition project (Smith 1893). A renewed request to the government was refused, but in 1886, when the State Government had recently taken over the Tasmanian Museum from the RST and commissioned a new gallery for it, the government offered a consolation prize to Launceston: £5000 to build a museum and art gallery. That offer was taken up with alacrity, and an architectural competition for the design was judged in 1887. The winner was a seventeen-year-old local lad, John Duncan, and his building was opened in 1891. The building is floridly Victorian, with features plagiarised from earlier Launceston buildings, and still forms part of the Queen

PLATE 8 – The former Custom House, Hobart, designed by Orlando Baker and built in 1899–1900, is now part of the Tasmanian Museum and Art Gallery and includes the current premises of the Royal Society of Tasmania, occupying the corner office and meeting room on the ground floor at right on Davey Street. Photo: Lynden Leppard

PLATE 9 – The Launceston Mechanics' Institute, in Cameron Street, circa 1867. Photo: William Cawston, Archives Office of Tasmania, Libraries Tasmania's Online collection, https://stors.tas.gov.au/PH30-1-5

PLATE 10 – W.H. Carpenter, *Launceston Museum,* c. 1887, pen and ink and watercolour on paper. The drawing shows the original collection in the then new annexe to the Launceston Mechanics' Institute, and glass cases purchased from the Royal Society; some of them had been in Lady Franklin's Museum. Queen Victoria Museum and Art Gallery, Launceston

Victoria Art Gallery at Royal Park. Duncan's design for the Albert Hall, built in 1890 for what became the Tasmanian International Exhibition of the following years, had been awarded a premium in the competition for that building, and his name appears on the foundation stone, although at least two other architects were involved in the final design. As the hall usurped the site of the venerable Launceston Horticultural Society's pavilion, that Society was give a permanent right to occupy part of it after the Exhibition closed. The hall was named after Albert, Queen Victoria's Prince Consort, begetter of the Great Exhibition of 1851 in London, so the Launceston Museum and Art Galley was named after the Queen. As 'Victoria Museum' invited confusion with institutions in the successful daughter colony across Bass Strait, it was soon renamed the Queen Victoria Museum and Art Gallery (pl. 11). After his two early successes, John Duncan was lost to architecture, entering the world of business through a family firm; he died while General Manager of the Launceston Bank for Savings in 1936 (Ratcliff 2017).

The collections of the former RST Northern Branch, held by the Mechanics' Institute, came into the hands of the Launceston Municipal Council, and formed the nucleus of the collections of the new Museum and Art Gallery.

In 1910, a building for the Launceston Technical College was added in matching style to the original Museum and Art Gallery with the clear intention that it would eventually be occupied by that institution, as indeed it was from 1927 (Proverbs 1988, pp. 30–32). There was a large room on the ground floor with its own outside entrance, and that became the venue for meetings of the Northern Branch, as well as housing the libraries of the Museum and the Branch itself. A purpose-built lecture hall was later added at Royal Park, again with a separate entrance so that it could be used when the Museum was closed; although well-appointed, heavy rain on its roof could render a speaker's words inaudible. New meeting spaces were provided at the Inveresk campus of the Museum and Art Gallery, created within the former Launceston Railway Workshops complex and opened in 2001. A succession of curators and directors who served as secretaries to the Northern Branch had welded the association between the Society and the Museum, which is a proud protectorate of the Launceston City Council. The formal link with the City and the institution continues.

CONCLUSION

In the brief but instructive evolution of British architecture in Van Diemen's Land and Tasmania, some of the buildings discussed in this paper represent particularly interesting transitions in taste and fashion. Lady Franklin's museum is a rare antipodean representative of what James Stevens Curl prefers to call the 'Doric Revival', as it differentiates so clearly from other varieties of Neoclassicism (Curl 1993, pp. 74–76). The Royal Society of Tasmania's first foray into building, within the Botanical Gardens, appears to have been in an indeterminate Regency style that partook of both the Gothick and the Georgian style. The building that became Parliament House confounds Georgian with Doric Revival. The Macquarie Street mansion that housed the Society's first public museum was in an advanced transitional style peculiar to Glasgow, built at a time when most colonial buildings were still Regency descendants of the Georgian hegemony. The Tasmanian Museum is a chaste herald of the Victorian Italianate that came to dominate architecture throughout Australia. The Victoria Museum in Launceston represented its more florid High Victorian development, and the former Custom House in Hobart, where the Royal Society of Tasmania currently meets, its Edwardian death-throes.

The Lady Franklin museum is recognised as one of the most important representatives of its style in Australasia, while the Secretary's Cottage still stands in Tasmania's Royal Botanical Gardens, its origin apparently forgotten. The Royal Society's Tasmanian Museum influenced the development of the civic precinct in which it stands and set a standard for the further housing of the major public institution that occupies it today. The choice of site has led to the inclusion of buildings that date from the earliest decades of British settlement to the late twentieth century, and has ensured the preservation and use of a number of historic structures despite the restrictions this imposes on its future growth. The anticipated electoral effect of the transfer of its ownership to the State converged with the need to house a collection that had its origin in that of a former branch of the Society, and resulted in the foundation of the Queen Victoria Museum and Art gallery in Launceston.

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PLATE 11 – The Victoria Museum and Art Gallery, Wellington Street Launceston, as it was circa 1897 (copies of the drawings held in the National Archives of Australia are displayed within the building, pl.8). Photo: Libraries Tasmania's Online collection, https://stors.tas.gov.au/ LPIC22-1-53

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EFFECTS OF GARDEN TYPE AND DISTANCE FROM BUSH ON ADVENTIVE TREES IN DOMESTIC GARDENS

by Megan Husband and Jamie B. Kirkpatrick

(with three text-figures and two tables)

Husband, M. & Kirkpatrick, J.B. 2021 (15:xii) Effects of garden type and distance from bush on adventive trees in domestic gardens. *Papers and Proceedings of the Royal Society of Tasmania* 155(2): 111–116. ISSN 0080-4703. School of Geography, Planning, and Spatial Sciences, University of Tasmania, Private Bag 78, Hobart, Tasmania 7001, Australia. (MH and JK*). *Author for correspondence. Email: j.kirkpatrick@utas.edu.au

Gardens are both a source of plant species that invade native vegetation (bush) and are places that native species can invade. We test the hypotheses that the richness of adventive exotic and native trees in suburban gardens declines with distance from the bush, and that the type of garden strongly influences the establishment of adventive trees. The adventive woody species in front gardens of houses on randomly selected streets in three Hobart suburbs were observed from the street, along with garden type. Distance from the bush boundary was measured from maps. Most taxa occurred less frequently with increasing distance from the bush and garden type was associated with the occurrence of several taxa. Distance and garden type had no effect on the exotic *Pittosporum undulatum*, possibly because it is rare in native vegetation due to its fire sensitivity but is both attractive to many gardeners and well-dispersed by birds between gardens.

Key Words: *Acacia, Bursaria, Cotoneaster,* dispersal, eucalypts, *Dodonaea, Exocarpos, Pittosporum undulatum,* suburban gardens.

INTRODUCTION

Over half of the world's population live in urban areas (Giles-Corti *et al.* 2016). Much of these urban areas, especially in richer countries, are devoted to private gardens (Loram *et al.* 2007), often located adjacent to remnants of natural vegetation. Gardens provide habitat for fauna, the species composition of which varies by garden characteristics (e.g., Daniels & Kirkpatrick 2006a, Smith *et al.* 2006). Gardens are also a source of weeds that invade adjacent natural vegetation (Groves *et al.* 2005, Alston & Richardson 2006, Ivey-Law & Kirkpatrick 2015, Guo *et al.* 2019). However, these weeds appear to be as often dispersed from natural vegetation to gardens as they are from gardens to natural vegetation (Zagorski *et al.* 2004). Plants native to natural vegetation in urban areas may also be able to colonise gardens from natural vegetation or from remnant individuals that have survived urban development.

The probability of adventives from natural vegetation is likely to decrease with distance from the interface of bush with suburbia, given the reverse-J dispersal curves typical of plants (Vittoz & Engler 2007). Individual survivors of suburbanisation are also likely to decrease in density with distance as well, as old trees are successively removed (Kirkpatrick *et al.* 2011 and 2013). The probability of survival of adventives in gardens is likely to be largely a function of the preferences and activities of gardeners. The variability of preferences and activities (Kirkpatrick *et al.* 2012, van Heezik *et al.* 2013) can result in adjacent gardens that markedly differ in their species composition and structure (Thompson *et al.* 2003, Kirkpatrick *et al.* 2009), even within small distances. Distinct garden types have been recognised in Hobart, Tasmania (Daniels & Kirkpatrick 2006b, Kirkpatrick *et al.* 2007), as have strong relationships between the attitudes of gardeners and the type of garden (Zagorski *et al.* 2004). Gardeners who prefer exotic species and who spend much time weeding their gardens are likely to remove any native adventives, whereas those who prefer natives or avoid weeding are less likely to remove native adventives (Zagorski *et al.* 2004). Thus, we can expect that garden type will affect the success of adventives.

This paper tests whether adventive native and exotic tree species in gardens are associated with native vegetation, the degree to which there is distance decay in their distributions in gardens and whether there is variation in their incidence by garden type.

METHODS

Three inner Hobart city suburbs of West Hobart, Sandy Bay and North Hobart (fig. 1) were sampled by selection of sections of streets and roads with similar block sizes and socioeconomic status to provide varying distances from native vegetation, which largely consisted of dry eucalypt forest and woodland. Two hundred and nine gardens were used in the analyses.

Distance from native vegetation to each front garden was measured using the tool in LISTmap. Presence or absence of the following species in the section of the garden visible from the street was recorded: *Pittosporum undulatum* Vent. (Sweet Pittosporum), *Cotoneaster* spp., *Exocarpos cupressiformis* Labill. (Cherry Ballart), *Dodonaea viscosa* Jacq. (Hopbush), *Bursaria spinosa.* Cav. (Sweet Bursaria), *Acacia dealbata* Link. (Silver Wattle), *Acacia melanoxylon*

FIGURE 1 – Location of the streets in the city of Hobart, Tasmania, Australia within which front gardens were sampled (marked in blue) with respect to the natural vegetation boundary (marked in green). Location of top right-hand corner of map: 42°52'31"S 147°22'3"E.

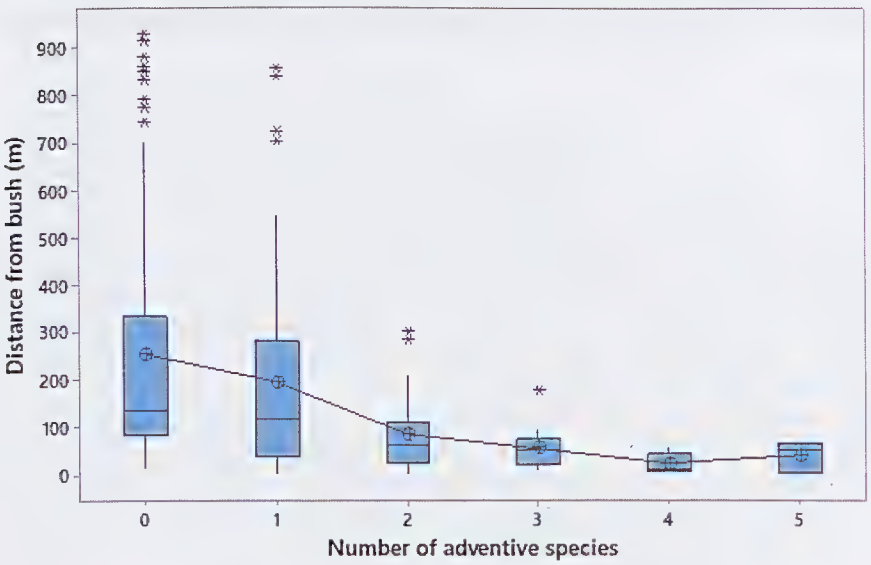

FIGURE 2 – Number of adventive species by distance from bush. The boxes contain 50% of the observations, the whiskers and outliers above and below 25% each. The median is a horizontal line. Lines connect the means.

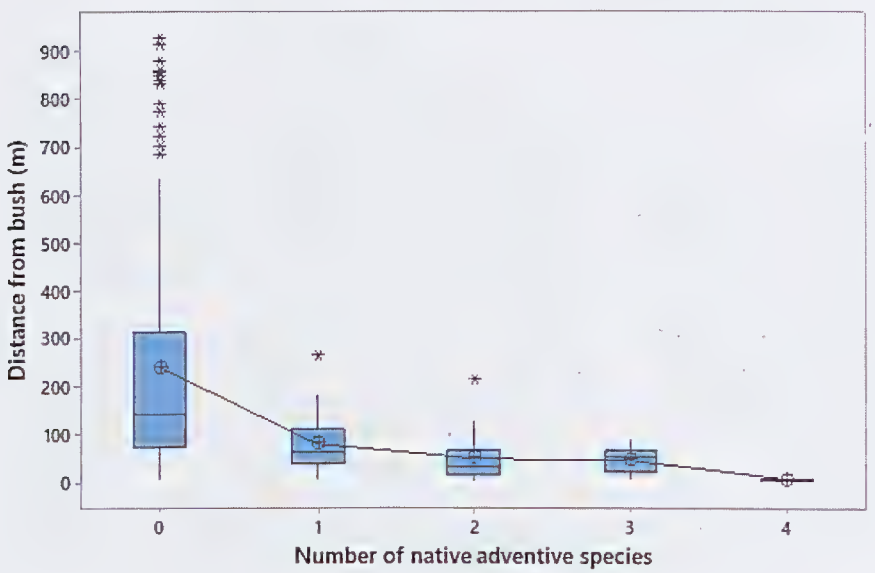

FIGURE 3 – Number of native adventive species by distance from bush. The boxes contain 50% of the observations, the whiskers and outliers above and below 25 % each. The median is a horizontal line. Lines connect the means.

R.Br. (Blackwood), *Acacia mearnsii* De Wild. (Black Wattle), *Eucalyptus pulchella* Desf. (White Peppermint) and *Eucalyptus viminalis* Labill. (White Gum). The first two were examples of non-native trees, and the remainder were trees native to adjacent bushland. Of these native trees, *Exocarpos* and *Acacia* seed can be transported by birds, with the remaining species having seed that is normally weakly dispersed by wind close to its source, with almost all seed from eucalypts deposited within twice tree height. *Exocarpos*, *Acacia* and *Dodonaea* have persistent soil seed stores (Bezemer *et al.* 2013). Garden type, as defined by Daniels and Kirkpatrick (2006b), was recorded.

One-way ANOVA, using Welch's test to account for non-equal variances, was used to test the relationship between distance from the bush and the presence/absence of individual taxa. ANOVA, assuming equal variances was used to determine the relationship between garden types (complex flower gardens, exotic shrub gardens, minimal input exotic gardens, shrub and bush tree gardens, simple native gardens, and woodland garden) and each of adventives per garden, native adventives per garden and the distance from native vegetation. Tukey's test was used to determine the significance of individual differences between garden types. Chi squared was used to determine if the frequency of adventive taxa varied between garden types. All statistical analyses were undertaken in Minitab version 18 (https://www.g2.com/).

RESULTS

The numbers of adventive species, and native adventive species, in gardens declined strongly with distance from native vegetation (figs 2, 3), with all observed native adventives being within 300 m of the bush (fig. 3). Gardens with native adventives were, on average, much closer to native vegetation than those without native adventives (64 m cf. 293 m) (table 1). The nearest native species to the bush boundary was *Bursaria spinosa*, followed in order by *Exocarpos cupressiformis*, *Eucalyptus pulchella*, *Acacia mearnsii*, *Dodonaea viscosa*, *A. dealbata*, *E. viminalis* and *A. melanoxylon* (table 1). The exotic, *Cotoneaster*, although significantly concentrated near the bush boundary, had a greater mean distance than any of the native species (table 1). The other exotic, *Pittosporum undulatum*, was ubiquitous (table 1).

There was no difference between garden types in their mean distance from the bush boundary or the mean species richness of all adventives (table 2). However, the mean native adventive species richness of the simple native garden was greater than that of the exotic shrub garden and the woodland garden (table 2). The highest percentage frequency of both all adventives and native adventives was in the shrub and bush tree garden and the least in the complex flower garden (table 2). *E. viminalis* was significantly differentiated between garden types, its percentage frequency being highest in the shrub and bush tree garden and least in the exotic shrub garden (table 2).

DISCUSSION

The lack of significant differentiation between garden types in mean distance from the bush boundary gives us confidence that our analysis of the effects of both garden type and distance from bush are not substantially biased by variation in the location of garden types.

The distance from the bush boundary to where a species is found may be influenced by patterns of dispersal of their disseminules from natural vegetation, dispersal from remnant bush trees in gardens or dispersal from trees that have previously invaded gardens from the bush or other gardens. Inter-garden migration seems likely to have

TABLE 1 – Mean distances from natural vegetation of gardens with and without taxa of adventive tree species and all local native species

Taxon	Distance (m)		F	P (Welch's test)
	Present	Absent		
Pittosporum undulatum	196	186	0.07	0.787
Cotoneaster species	115	218	15.08	<0.001
Acacia melanoxylon	85	195	23.06	<0.001
Eucalyptus viminalis	78	203	35.84	<0.001
All local native species	64	239	69.25	<0.001
Acacia dealbata	52	194	50.98	<0.001
Dodonaea viscosa	50	205	57.35	<0.001
Acacia mearnsii	44	192	45.36	<0.001
Eucalyptus pulchella	34	197	82.47	<0.001
Exocarpos cupressiformis	27	196	96.50	<0.001
Bursaria spinosa	24	195	92.81	<0.001

TABLE 2 – The percentage frequency of adventive taxa in gardens and gardens of different types, mean richness (number) of adventives and mean distance from natural vegetation

	CF	ES	MIE	SBT	SN	W	All	P
N	16	39	63	19	38	34	208	
All	31.25	48.72	52.38	**78.95**	65.79	50.00	55.55	**0.044**
All Native	12.50	17.95	25.40	**63.16**	44.74	17.65	28.71	**0.001**
Cotoneaster spp.	18.75	17.95	31.75	21.05	34.21	38.24	28.71	0.297
Pittosporum undulatum	6.25	28.21	20.63	26.32	10.53	23.53	20.10	0.212
Eucalyptus viminalis	6.25	0.00	12.70	**31.58**	18.42	5.88	11.48	**0.003**
Acacia melanoxylon	0.00	0.00	9.52	21.05	5.26	0.00	5.19	-
Eucalyptus pulchella	0.00	7.69	1.59	10.53	10.53	2.94	4.76	-
Exocarpos cupressiformis	0.00	5.13	3.17	5.26	7.89	2.94	4.76	-
Acacia dealbata		0.00	2.56	6.35	5.26	7.89	0.00	4.33
Bursaria spinosa	0.00	0.00	3.17	0.00	13.16	2.94	3.46	-
Acacia meamsii		0.00	0.00	0.00	5.26	7.89	2.94	2.60
Mean richness of natives	0.19AB	0.28B	0.41AB	0.84AB	**0.89A**	0.29B	0.48	**0.003**
Mean richness of adventives	0.44	0.74	0.94	1.32	1.34	0.91	0.94	0.057
Mean distance (m)	192	233	185	135	130	236	205	0.227

P = probability (Chi Square likelihood ratio for taxa, ANOVA for others, ANOVA means with same letter (A or B) in a row are identical at P > 0.05). Bold indicates the highest value in a row in which there is significant differentiation. CF = complex flower, ES = exotic shrub, MIE = minimum input exotic, SBT = shrub and bush trees, SN = simple native, W = woodland.

dominated in the distribution of *Pittosporum undulatum*, a species native to mainland eastern Australia, which is rare in the bush because of its fire sensitivity (Gleadow & Ashton 1981). *Pittosporum undulatum* is tolerant of dry conditions, is dispersed by native and exotic birds (Gleadow & Ashton 1981) and is an attractive small tree with highly scented flowers and dense glossy foliage, making it less likely to be removed by weeding than less attractive plants. The other exotic taxon we observed was *Cotoneaster*, which is dispersed by birds from the bush to gardens and vice-versa, as well as between gardens (Zacharek 1990, Zagorski *et al.* 2004). The concentration of *Cotoneaster* near the bush boundary, despite a widespread occurrence, indicates dispersal from the bush, which can occur up to 400 m through the agency of native birds (Zacharek 1990).

The close proximity of the native adventive species to the bush boundary suggests a strong role of dispersal from the bush. However, in many cases the species may have persisted on suburban blocks that were not totally cleared before house construction. The species with the highest mean distances from the bush are trees that were previously widespread in the study area, but they are no more widespread than many of those with lesser mean distances. Different species of *Eucalyptus* and *Acacia* have a wide range of mean distances, despite little variation in seed dispersal mechanisms between congeners, suggesting that their pre-suburbanisation patterns of distribution may have played a role in determining their present distributions in gardens.

The concentration of native and total adventives and *E. viminalis* in shrub and bush tree gardens and simple native gardens is likely to reflect the nativist values of the gardeners, as well as their tendency to leave the garden to itself (Zagorski *et al.* 2004). The low percentage frequency of both all adventives and native adventives in complex flower gardens reflects the intensity of weeding of this garden type, combined with a preference for exotics and herbs (Zagorski *et al.* 2004). The exotic shrub gardens and woodland gardens that have lesser native adventive species richness than the simple native gardens are also well-weeded. The woodland gardener does incorporate the less straggly of native trees into their rich palette, while local natives are generally not planted by exotic shrub gardeners (Daniels & Kirkpatrick 2006b).

We conclude that there is highly likely to be dispersal of trees from bush into gardens, that this dispersal is concentrated close to natural vegetation, and that the type of garden is associated with variation in the propensity of adventive trees to establish. It may be possible to increase the conservation and amenity values of at least some gardens by informing the gardeners about the values of the native species that are likely to colonise their gardens. For example, *Exocarpos cupressiformis* is an attractive small tree that has bird-dispersed fruits with arils that are eaten by many animals, including humans. It is also apparent that concentrating efforts to control the exotic *Cotoneaster* species in gardens and bush close to the boundary is highly desirable.

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THE GEOLOGY AND GLACIAL HISTORY OF THE WALLS OF JERUSALEM, CENTRAL TASMANIA – A PRELIMINARY STUDY

by Keith Corbett

(with three text-figures and 11 plates)

Corbett, K.D. 2021 (15:xii): The geology and glacial history of the Walls of Jerusalem, Central Tasmania – a preliminary study. *Papers and Proceedings of the Royal Society of Tasmania* 155(2): 117–128. ISSN: 0080-4703. 35 Pillinger Drive, Fern Tree, Tasmania 7054, Australia. Email: keith.corbett@bigpond.com

The Walls of Jerusalem, in Tasmania's Central Plateau, is marked by several dolerite escarpments, or "walls", enclosing sheltered grassy valleys with Pencil Pine forests. Geologically, the area is a structurally raised block between two faults, with the peaks and plateaus being 100 m or so higher than the surrounding plateau. The valleys and escarpments may be mainly due to intense faulting and shattering of the dolerite by cross-faults, and removal of this material by glaciers. The higher peaks and plateaus have all been abraded by ice, except for an extraordinary patch at Solomons Throne, which retains irregular scree piles coloured red with lichen. Virtually all the valley floors are covered by glacial till, which probably relates to the younger glacial episodes. It consists mostly of dolerite boulders and clay, and shows subdued morainal forms in most places, with a few matrix-free boulder deposits probably representing lag after meltwater washing. Bedded clay deposits formed in lakes and meltwater streams as the ice retreated are extensive within the drift deposits, reflecting the confined nature of the two glacier lobes which entered the valleys from north and south. Dolerite screes along the scarps appear to post-date most of the morainal deposits, but some older screes may also be present. The Temple eminence within the centre of the Walls consists of fragmented dolerite overlying Triassic sandstone, almost completely covered by periglacial and glacial deposits, including superb examples of solifluction flows. There are many unanswered questions concerning the glacial deposits, but the lack of any dates means it is not yet possible to establish a comprehensive glacial chronology.

Key Words: Walls of Jerusalem, Tasmania, geology, glacial history.

INTRODUCTION

The Walls of Jerusalem ("the Walls") is a distinctive alpine area near the western margin of Tasmania's Central Plateau (fig. 1) and is a popular destination for bushwalkers. A series of dolerite "walls" enclose several linked grassy valleys within which are a number of small glacial lakes and tracts of ancient Pencil Pine *Athrotaxis cupressoides* forest. The area was included in the much larger Walls of Jerusalem National Park in 1981 and is now part of the Tasmanian Wilderness World Heritage Area. The area was glaciated multiple times during the Pleistocene Ice Age and preserves a complex variety of glacial and periglacial deposits (as shown in this paper).

Aboriginal artefacts have been found in several places within the Walls, indicating that the area was used by Tasmania's indigenous people, although dates are not known. It could well have been a popular place because of its sheltered grassy valleys and abundant game.

Sheep and cattle have been grazed on the Central Plateau ("the Plateau") since the early 1800s, and cattle may have reached the Walls area in the mid-1800s, when winter fur-trapping was also being undertaken. Surveyor James Scott named a number of features in the area in the late 1840s, by which time the "Walls of Jerusalem" name was already in vogue. The term "China Walls" has also been applied to the area. Scott's early map shows a stock route for cattle from the Great Lake area via the Walls to the upper Mersey Valley (Jetson 1989, Cubit 2016). Reg Dixon brought cattle into the Walls in the 1940s, driving them across the Plateau from Mole Creek, and built the "Dixons Kingdom" log hut which bears his name. Cattle were still to be seen grazing in the Walls valleys in the 1960s (Terry 2005).

Bushwalking became popular on the Plateau in the early 1900s, and Reg Hall, a Launceston solicitor, gave many of the Walls features their interesting names in the 1930s, based on the old city of Jerusalem with its many gates and walls. Bushfires have ravaged the Plateau many times over the past century, the most recent being in 1960–61 (Marsden-Smedley 1994, Corbett 1996). This fire, thought to have been deliberately lit and maintained, burnt across much of the western Plateau and patchily into the Walls of Jerusalem area and destroyed many native Pencil Pines.

This paper is based on fieldwork carried out at the Walls on a 10-day trip in February 2011, when the area was mapped using aerial photos and 1:10 000 scale topographic maps. Over 200 field observation points were made.

PHYSIOGRAPHY AND TERMINOLOGY

The dolerite-capped Central Plateau has an average elevation of about 1300 m near its western margin, which is deeply embayed by the valleys of the Fish and Little Fisher rivers. These rivers feed into the large N–S glacial valley containing the Mersey River and Lake Rowallan at an elevation of

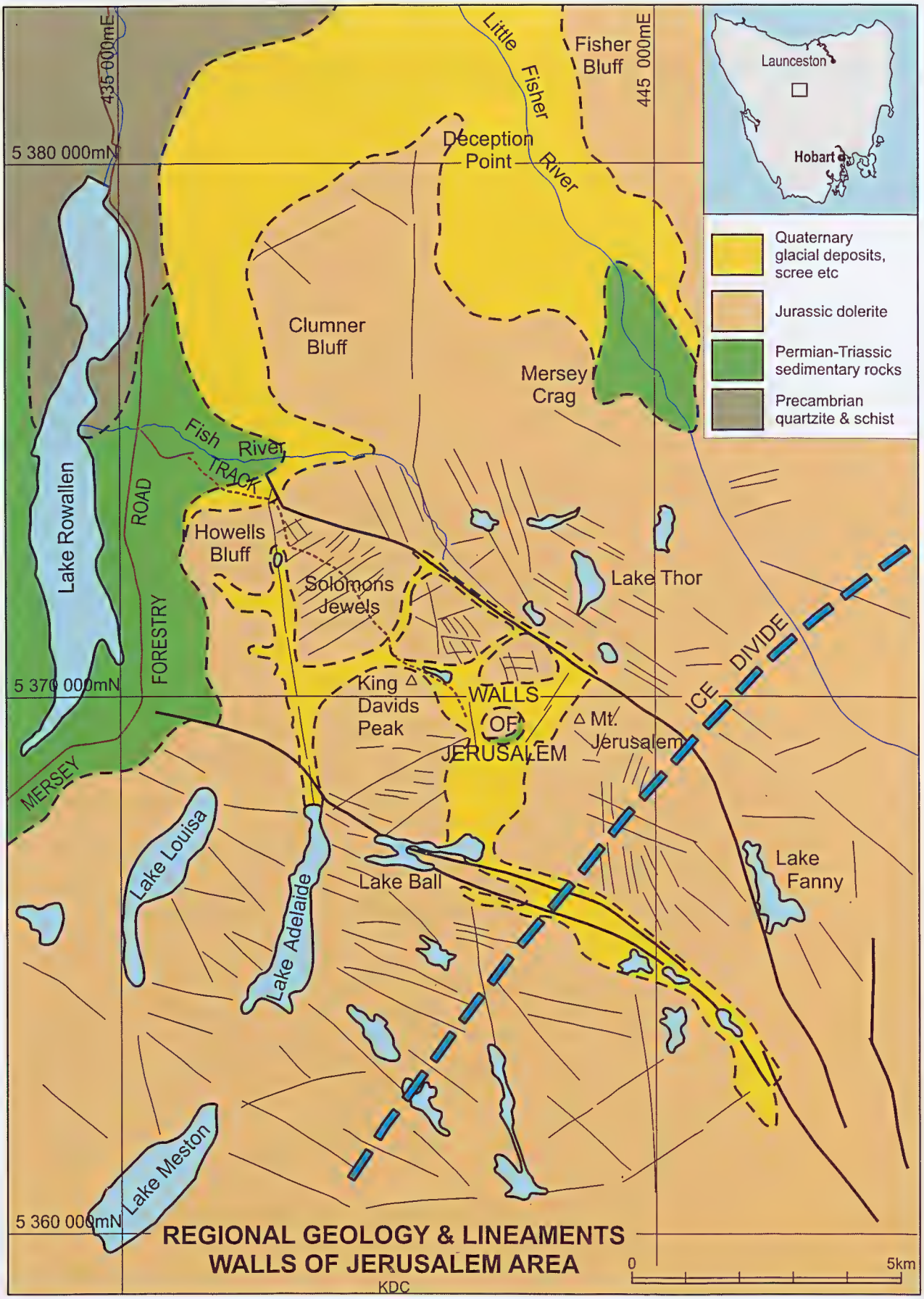

FIG. 1 – Regional geology of the western Central Plateau–Walls of Jerusalem area, showing major lineaments in the dolerite. Modified after Jennings *et al.* 1961.

about 500 m. Access to the Walls is via the Mersey forestry road and a side road near the Fish River which leads to the beginning of the walking track. This track climbs the escarpment, more or less following the old stock route, to Lake Loane, then crosses the plateau past a series of small lakes known as Solomons Jewels, to enter the Walls at Herods Gate, on the NW corner (figs 1, 2). An alternative walking route crosses the Plateau from the east, via Lake Fanny and a cairned route to Mt Jerusalem.

The Walls area comprises a N–S trending roughly Y-shaped depression, 1–3 km wide and 4 km long, bounded to the east, west and north by dolerite escarpments, averaging about 100 m high, with some gaps or "gates". The East Wall has Mt Jerusalem (1459 m) as its highest point at the northern end, and its southern extension has three prominent dolerite buttresses separated by saddles. The western escarpment is V-shaped in plan and comprises Mt Moriah (1362 m) in the south, followed by the Wailing Wall leading to Solomons Throne (1469 m) at the point of the V, followed by the NW-trending West Wall, with King Davids Peak (1499 m) forming the high point at the northern end. The northern margin of the Y is formed by two rounded flat-topped dolerite hills, Mt Ophel (1335 m) and Zion Hill (1395 m), separated by a narrow, glaciated valley referred to as Ephraims Gate. To the north of these hills is the NW-trending valley of Zion Vale, which joins the eastern arm of the Y at the foot of Mt Jerusalem.

At the centre of the Y is the rounded dolerite hill known as The Temple (1446 m), which has saddles to the west and east at about 1300–1350 m, referred to as Damascus Gate (west) and Jaffa Gate (east).

The two northern arms drain generally northwestwards into the Fish River and thence into the Mersey, while the southern arm drains into Lake Ball and thence southeastwards into the Pine River and eventually into the Derwent River. The main lakes within the Walls are Lake Salome, just inside Herods Gate, the Pool of Siloam just to the NE of this, within Ephraims Gate, the small Pool of Bethesda under the NW flank of The Temple, and the much larger Lake Ball at the southern entrance. Several smaller lakes and ponds dot the valleys. The area surrounding the Walls to the north, east and south has hundreds of small lakes, and is known as "the land of a thousand lakes". To the SW of the Walls are several N–S-oriented narrow valleys containing large lakes such as Adelaide, Meston and Louisa.

The vegetation in the valleys varies from wetlands with *Sphagnum* sp. and *Richea scoparia* to open grassland and sedgeland to scrub- or heath-covered areas, to native pine forest and Snowgum *Eucalyptus coccifera* woodland. Copses and clumps of Pencil Pine are common, as are the larger forest areas, which include the largest known Pencil Pine forest in the state, on the south side of The Temple. The pine forests are unusual in having a grassy understorey in large part, their formation possibly influenced by Aboriginal burning.

REGIONAL GEOLOGICAL SETTING AND GLACIAL HISTORY

The Central Plateau consists essentially of Jurassic dolerite, in the form of a large sub-horizontal sill of the order of 200–400 m thick. Many faults and joints are present in the dolerite (fig. 1), along which weathering and erosion has produced small escarpments and linear valleys and grooves all accentuated by glacial erosion. The major escarpments at the edges of the Plateau have significant cliff sections in many areas, displaying classical organ-pipe columnar jointing. Howells Bluff, Clumner Bluff, Mersey Crag and Fisher Bluff are typical examples in this general area. The other feature which is typical of dolerite areas is the presence of extensive fields of coarse bouldery slope deposits below the cliffs.

The basic geology of the area was established during the only previous geological survey, this being the mapping of the Du Cane sheet (1:63 360) by the Government Geological Survey in 1961 (Jennings *et al.* 1961, Macleod *et al.* 1961). Many of the linear features in the dolerite were mapped during this work, as were the Triassic rocks at The Temple. A sequence of Triassic sandstone and Permian mudstones underlies the dolerite and extends down to valley level on the western escarpment, with the underlying basement of Precambrian quartzite and schist exposed at the northern end of Lake Rowallan. Much of this sedimentary sequence is covered by slope deposits. A few small exposures of the Triassic sediments are found on the Plateau itself, beneath the dolerite at some of the higher escarpments, such as within the Walls of Jerusalem.

Faults and lineaments can clearly be seen in the dolerite on aerial photographs. The most prominent fault in the Walls area trends WNW along the line of the Great Pine Tier escarpment, passing through Lake Ball on the south side of the Walls and out into the Mersey Valley (fig. 1). This fault has a north-side-up displacement of the order of 170 m (Macleod *et al.* 1961). A sub-parallel NW-trending fault lies just north of the Walls, following the Zion Vale lineament and extending SE of Mt Jerusalem, where it converges on the Pine Tier structure. The escarpments along this fault indicate south-side-up displacement of the order of 100 m. Thus, the Walls of Jerusalem area lies within a wedge-shaped 5-km-wide upfaulted block or horst, which is of the order of 100 m higher than much of the surrounding plateau. Many other lineaments are apparent in the dolerite, ranging from WNW to ENE in orientation.

The western part of the Central Plateau has been glaciated multiple times through the Pleistocene Ice Age (from 2.6 million years ago), and evidence of glaciation is widespread in the form of abraded dolerite landscapes, scraped out lineaments, numerous glacial lakes, and areas of moraine. Jennings and Ahmed (1957) recognised that there was an ice divide just to the east of Mt Jerusalem (fig. 1), between west-flowing and east-flowing ice, and this work was expanded by Derbyshire *et al.* (1965). A regional study by Kiernan (1990) showed that during the glacial maximum period, in the early Pleistocene or possibly late Pliocene, a large ice sheet extended for 100 km from the

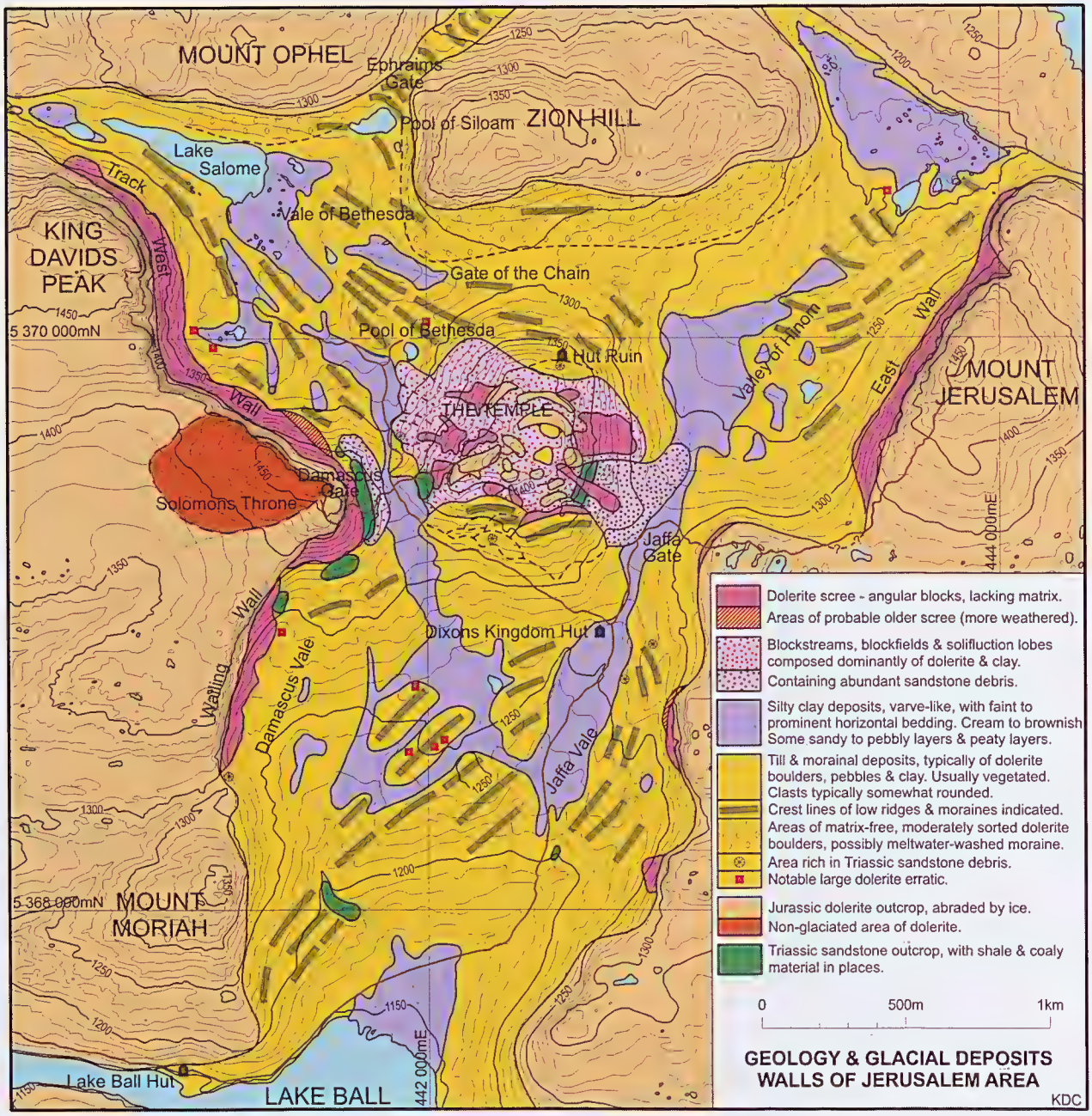

FIG. 2 – Geology and glacial deposits of the Walls of Jerusalem area, as mapped by the author.

Central Plateau west to the West Coast Range, with large valley glaciers down the major river valleys such as the Mersey, Forth, Pieman, King and Derwent. The maximum ice thickness is estimated to have been at least 700 m in the upper Murchison River area, some 20–30 km west of the Central Plateau. This ice would have overridden all but the highest peaks. Ice from the Central Plateau and adjacent areas flowed down the Mersey Valley to well beyond Sheffield. However, the east-flowing ice on the Central Plateau at this time was apparently much thinner and less active and appears to have just reached the western margin of Great Lake.

During the most recent glacial period, known as the Last Glacial Maximum (19–26 ka), ice in Tasmania reached its greatest extent between ~19–22 ka, but was less extensive than during earlier glacial periods. At this time, the ice sheet covered just the western part of the Plateau, and a glacier flowed down the Mersey Valley for a few kilometres north of Lake Rowallan. This stage was named the Rowallan Glaciation by Hannan and Colhoun (1987), from studies in the Mersey Valley. The east-flowing ice from this stage extended for only a few kilometres and did not reach Great Lake. The previous, or penultimate glaciation, approximately 130 000 years old, was somewhat more extensive, and was named the Arm Glaciation (Hannan & Colhoun 1987). Hannan and Colhoun (1991) briefly examined the evidence for glacial activity within the Walls of Jerusalem as part of a more regional reconnaissance study of the larger Walls of Jerusalem National Park area, as discussed later. Further observations on the glaciation of the Plateau were recorded by Sib Corbett (Corbett 1996).

GEOLOGY OF THE WALLS AREA

The Walls area stands out within the general plateau landscape, firstly for having several higher points, by 100 m or so, and secondly by having a larger than normal area of till or moraine. The actual extent of the glacial drift has not been appreciated until the present study, which has revealed that virtually all the valley floors at the Walls, including the areas of the saddles beside The Temple, are covered by either till or lacustrine/fluvial clays derived from the till (fig. 2). The study also shows several outcrops of Triassic sandstone beneath the glacial drift, suggesting that much of the valley floor area consists of Triassic rocks rather than dolerite. This suggests that the valleys of the Walls, rather than being a series of down-faulted areas, may represent highly faulted and broken areas from which the dolerite has been excavated by ice. The faults responsible are no longer visible because of the drift cover but are presumably second-order structures on roughly NNW and NNE orientations. Many lineaments of this orientation are apparent in the surrounding dolerite. The upstanding Temple edifice appears to be a remnant of the original plateau, highly affected by faults and joints and consequently highly fragmented.

There is some suggestion that the dolerite sill which forms all the higher ground at the Walls may be thinner than normal for the general plateau area. The outcrop of sandstone under Solomons Throne, and that on the eastern flank of The Temple, reach to about 1370 m altitude, with the top of the dolerite at 1469 m and 1446 m, respectively. This gives a maximum dolerite thickness of 100 m at the Throne and 76 m at The Temple. There has been some erosion of the top of the dolerite at Solomons Throne, and probably more at The Temple, but nevertheless it could well be the case that the Walls was an area of thinner and weaker dolerite, which may have influenced the initial formation of the upfaulted horst structure.

Triassic rocks

Several small outcrops of Triassic rocks have been mapped within the Walls, some of them not previously noted. The most prominent outcrop is the obvious one on the eastern face of The Temple (pl. 1), where a large collapsed mass has exposed a strip of horizontally-bedded grey sandstone and shale, with some carbonaceous material and plant fossils in places, approximately 30 m thick. Large masses of this shale and sandstone are contained in the adjacent collapsed mass. The outcrops at The Temple have been ascribed to the "feldspathic sandstone" which forms the upper part of the Triassic sequence elsewhere (Macleod *et al.* 1961).

Similar sandstone and shale are exposed on and beside the walking track on the western flank of The Temple, and as a low cliff and several outcrops partly covered by till on the lower slopes of Solomons Throne and along Wailing Wall. Another major sandstone outcrop is present on the floor of the southern valley in the creek draining the eastern side of Mt Moriah, and a smaller one in another creek south of Dixons Kingdom hut (fig. 2). There is a very small outcrop at the head of a small creek below the West Wall.

PLATE 1 – View of eastern side of The Temple showing outcrop of Triassic sandstone and shale at head of a large, slumped mass of mixed Triassic rocks and dolerite. Note remnant dolerite outcrops and extensive blockfields and scree.

PLATE 2 – Contrast between glaciated area, in foreground, and unglaciated area at Solomons Throne. Note colour difference and abundance of scree in unglaciated area. Photo: Alan Pegg

In addition to the outcrops, there are several areas in the till deposits where there is an abundance of Triassic sandstone and shale fragments within seemingly shallow drift, strongly suggesting that there is outcrop of these rocks nearby. Some of these are noted in figure 2.

The distribution of the outcrops and sandstone-rich drift patches strongly suggest that nearly all the floor of the Walls valleys consisted of Triassic rocks before being covered by glacial deposits – an area of perhaps 5 km^2. This is far greater than any other occurrence of sedimentary rocks on the Plateau proper and serves to emphasise the uniqueness of the Walls area.

UNGLACIATED AREA OF PLATEAU DOLERITE

Although only limited fieldwork was carried out on the higher plateau parts of the Walls area for this study, it was apparent that nearly all of the high areas (e.g., the tops of Mt Jerusalem, King Davids Peak, Mt Moriah, Zion Hill, Mt Ophel, The Temple) had been ice-covered and were ice-abraded. The dolerite bedrock in these areas is smoothed, outcrops are rounded and typically grey in colour, and some small swales and depressions contain deposits with rounded clasts and clay which appear to be till (e.g., pl. 2).

The one extraordinary exception is an area of approximately 600 x 300 m at Solomons Throne, on the West Wall, at an altitude of 1460 m (fig. 2). There is a striking contrast between the glaciated and unglaciated areas here (pl. 2), with the glaciated area being smoothed, relatively free of loose material, and grey in colour, whereas the non-glaciated area is largely covered by angular blocky scree which is notably reddish in colour due to an abundance of red-brown lichen on all exposed surfaces. The reason for the extraordinary colour difference is uncertain but may in part be due to the red lichen being inhibited from developing on the ice-smoothed surfaces. It will be interesting to see if this criterion is applicable elsewhere.

It is difficult to see why the top of Solomons Throne, which is 30 m lower than King Davids Peak and only 10 m higher than Mt Jerusalem, was not glaciated at the same time. Perhaps the saddle on its eastern lee side meant there was less accumulation of snow and ice than in the deeper valley under King Davids Peak, or perhaps the presence of The Temple edifice to its east caused ice flowing from this direction to be thinned and somewhat deflected.

PLEISTOCENE GLACIAL AND ASSOCIATED DEPOSITS IN THE WALLS VALLEYS

Apart from the small "windows" of Triassic rocks, the floors of the Walls valleys, and much of The Temple area also, are covered by superficial deposits. These consist mostly of till or moraine made up of dolerite boulders and clay in most places, with some areas of clay-free "washed" boulders, particularly around Zion Hill. Perhaps somewhat unexpectedly in such an obviously glaciated area, narrow strips of dolerite scree are present along the cliff lines of the Western and Wailing Walls, and below Mt Jerusalem and several of the small buttresses along the southern part of the East Wall. The Temple area is most striking, being almost completely covered by periglacial deposits, particularly blockstreams and blockfields, with only a few scattered tors and small ridges of dolerite bedrock remaining (fig. 2).

Another unusual feature of the drift deposits is the extensive area of bedded clay and sandy clay extending down the valleys from the saddles on either side of The Temple and best developed across the flatter areas (fig. 2). These clays appear to be lacustrine and possibly fluvial deposits.

The stratigraphic relationships between the various deposits appear to be complex and have not been fully resolved. No age dates are available, and what few conclusions are possible are based on field relationships, i.e., what can be seen to overlie what, and to a lesser extent, on the relative degrees of weathering. Much of the complexity became apparent when the field data were analysed back in Hobart, with no opportunity for further field checking. Most of the deposits appear to be relatively "young", in the sense that no deeply weathered deposits, i.e., with dolerite clasts having thick weathering rinds (>15 cm), have been observed, but some differences in age are apparent.

The following account describes the deposits according to where they occur within the Walls, rather than their age, from The Temple area to the valley drift deposits, the clay deposits and the screes.

The Temple area

The Temple is a particularly complex area and could be described as a showcase of periglacial deposits. Although it projects 150 m or more above the general valley level, it has just a few remnant ridges and tors of solid dolerite remaining, surrounded by a "sea" of fragmental deposits. "The Ruined Temple" might be a better descriptor.

The most abundant material consists of a chaotic mixture of dolerite boulders with variable amounts of clay matrix, referred to as blockfields and blockstreams. Areas of similar material which lack clay have been mapped as scree. Much of this material appears to have "flowed" down the slopes as large solifluction flows, and there are superb examples of these on the NW flank near the Pool of Bethesda (pl. 3). The most prominent flow has a bulbous lower end near its contact on the underlying clay deposits and appears to have "ruckled" the clay into low ridges near the contact. This flow mass has patches rich in Triassic material, indicating that it has flowed over the Triassic outcrop zone. There is abundant clay in the lower part of this mass, but in its upper reaches are irregular zones of loose dolerite boulders, lacking matrix, the larger areas being mapped as scree. Similar areas of open matrix-free scree are present on the blockstream deposits around much of The Temple.

In profile, this NW face of The Temple shows a series of large steps within the blockstream material, suggesting a series of mass collapses, with boulder-covered slip faces at their head. This topography is similar, although at a smaller scale, to the great periglacial "topples" of dolerite which occur around the flanks of Ben Lomond (Caine 1983, Corbett, 2019). Similar stepped topography indicative of mass collapses is apparent on the south flank also.

A large composite blockstream, or solifluction flow, containing abundant Triassic debris as well as dolerite, is prominent on the eastern flank of The Temple, just below the outcrop of Triassic sediments (fig 2, pl. 1).

The slip face at its head contains the Triassic bedrock exposure, and a second slip face, marked by white-weathering Triassic material, is present within the upper part of the flow mass. The trench at the head of this mass has been partly infilled with coarse dolerite boulders, as is the case with several other blockstream masses. The "downstream" end of the complex flow mass has a well-exposed contact on the lacustrine clays above Dixons Kingdom hut (pl. 4) and shows several sub-lobes which have rolled over the underlying clays.

The southern flank of The Temple has a slightly different arrangement which has been more difficult to interpret. A large composite "hump" of coarse bouldery material, which appears to be till, is piled against the flank of The Temple here (pl. 5). At its upper limit, however, the mass of till appears to rest against blockstream-like material, which has a headwall trench filled with scree-like boulders, and a slip face scarp behind. In this area the till has been deposited, as an end moraine, against a slope consisting of

PLATE 3 – Large solifluction flow on NW flank of The Temple near the Pool of Bethesda. Note bulbous nose, upper scree-like deposits, and remnant tors of dolerite bedrock. Zion Hill to left, Mt Jerusalem on skyline to right.

PLATE 4 – Downstream end of large mass flow on east flank of The Temple, showing lobes which have rolled over the underlying lacustrine clays. Near walking track at Jaffa Vale.

PLATE 5 – The large "hump" of moraine on the SE flank of The Temple, viewed from the east. Note scalloped edge of Pencil Pine Athrotaxis cupressoides forest.

mass collapse material. Several nested ridges are apparent on the northern part of the hump, interpreted as end moraines related to the glacier lobe which must have filled the southern valley, presumably at multiple times.

A distinct sloping topographic surface, marked by the change from scrubby heath above to grassy Pencil Pine vegetation below, runs along the lower flanks of these moraine humps, separating them from the more "normal" moraine cover below (fig. 2, pl. 5). This scalloped surface appears to have been moulded by the most recent ice, perhaps as the ice retreated. The reason for the change in vegetation on this surface is not clear since both substrates appear to be moraine of dolerite boulders and clay.

There are also several patches of what is interpreted to be compacted moraine, identified by having some rounded clasts, pebbles and clay matrix, across the rounded summit area of The Temple. These patches are interspersed with dolerite outcrops and coarse angular blockfield material, but the age relationship between the moraine and blockfield was not determined. The dolerite outcrops are ice-abraded, in being smoothed and rounded, except where subsequently broken up, and grey in colour.

On the northern flank of The Temple, in the vicinity of the Temple Hut ruin, there is again a cryptic association of moraine and blockstream-like material. The deposits here are interpreted as being essentially lateral moraines related to the northern glacier lobe, with some later addition of dolerite boulder material from upslope.

The western slope of The Temple, in the vicinity of Damascus Gate, appears to be largely free of mass wastage deposits, perhaps because of the lower gradient in this area. Across the saddle, however, there is a band of solifluction flow material around and beneath the sandstone outcrop under Solomons Throne.

My observations at The Temple suggest the following conclusions:

- The Temple has been subject to intense periglacial, and direct glacial activity, for a very long period, and now consists largely of fragmental deposits, with only remnant patches of solid dolerite. It probably represents the last remnant of the great deal of shattered bedrock which has been removed to make the valleys.
- The Temple has been overridden by ice at least once, to produce the ice-abraded outcrops and the remnants of moraine around the summit as mapped.
- More recent glacial episodes have mainly reached the upper flanks of The Temple, depositing large hump-like end moraines particularly on the south side.
- Mass collapse/solifluction/blockstream masses have flowed off The Temple in several directions, some carrying significant amounts of Triassic material as well as dolerite.
- Several of these masses have overridden the lacustrine clays and moraine deposits around the flanks of The Temple.

The valley moraines and associated deposits

Till or ground moraine extends throughout all the valleys at the Walls, and onto the flanks of The Temple. Most of the till is in the form of low ridges with a subdued "smoothed off" appearance, but there are also areas of matrix-free bouldery material, particularly around Zion Hill, and of little-modified end moraine ridges in the narrow valley at

Ephraims Gate (fig. 2). Viewed from Mt Jerusalem (pl. 6), the moraine surface in the Valley of Hinom has a "scabby" appearance, with the low ridges and rises of moraine marked by speckled heathy vegetation, separated by more uniform grassy or sedgy vegetation in the wetter swales.

In the southern valley, there are several broad NE-trending moraine ridges with a similar speckled appearance, typically with scattered Snowgums *E. coccifera*, although much of the till-covered area is blanketed by Pencil Pine forest or mixed forest.

The moraine ridges are generally only 5–10 m high but up to 20 m or more in places. On the ground, the immediate impression is of a "smoothed off" surface, with small to large dolerite boulders projecting slightly above a vegetated surface (pl. 7). Most of the visible clasts are slightly to moderately rounded. Washout exposures show abundant smaller clasts to pebble size, again mostly rounded, in a brownish clayey matrix. The clasts do not appear to have significant weathering rinds.

Large to very large (>5 m) dolerite erratics are scattered over the moraine in all the valleys, and some have been mapped (fig. 2). The largest one measured was 30 x 20 x 10 m, just NE of the Pool of Bethesda. Some have partially broken up since being deposited. In one or two cases, it was difficult to confirm whether the dolerite mass projecting through the till was a large erratic or bedrock.

"Washed" moraine

What appear to be "washed" moraine deposits are present along the northern edge of the valley (Gate of the Chain) flanking Zion Hill (fig 2, pl. 8), extending into the side valley at Pool of Siloam, and was noted in several other smaller areas. The most notable example is a linear zone along the contour, several hundred m long and roughly 15 m wide, completely lacking vegetation (pl. 8). It consists of sub-rounded dolerite boulders, mostly less than 0.5 m, hence apparently sorted with no apparent matrix. The reason for the lack of matrix, and the apparent sorting, is uncertain, but perhaps best explained as being due to washing by meltwater running off the ice along this edge (K. Kiernan, pers. comm.).

Two series of arcuate end moraines are present within the narrow valley containing the Pool of Siloam (Ephraims Gate, fig. 2). One set is concave to the south, indicating deposition by ice retreating from the Lake Salome area, and the second series, in the northern part of the valley, is concave to the north, related to retreat of ice from Zion Vale.

The valley moraine has an interesting contact with the scree slope in one area under the West Wall. A distinct low ridge of unvegetated bouldery material is present along the contact here, consisting partly of moraine boulders, i.e., rounded, and partly of angular scree boulders. A mixture of very coarse scree, with boulders to 4 m+, and finer scree, possibly of two different ages, extends up the slope. This contact is interpreted as the edge of the ice, possibly the most recent in the valley, interacting with an existing scree field to produce a lateral moraine containing a proportion of scree boulders. Washing by meltwater running off the

PLATE 6 – View from Mt Jerusalem over Vale of Hinom to The Temple, showing low moraine ridges on valley floor separated by grassy/sedgy swales. Lake Salome in distance between King Davids Peak and Zion Hill. This photo taken in 1986 shows patches of fire damage from the 1961 fire.

PLATE 7 – Typical moraine surface near the Pool of Bethesda. Dolerite boulders project above smoothed vegetated surface. Washout shows brownish clay and rounded pebbles.

PLATE 8 – Matrix-free boulder deposit along south flank of Zion Hill, looking east to Mt Jerusalem. Considered to be due to washing by meltwater coming off the ice.

ice edge may be the cause of the lack of matrix. This type of lateral moraine may only be of local extent along the western walls, and elsewhere it appears that younger scree has come down over the margin of the moraine.

THE LACUSTRINE – FLUVIAL CLAY DEPOSITS

Most of the flatter areas and creek lines in the valleys are underlain by deposits of creamy yellow to brownish clay, typically with faint to prominent horizontal bedding (pl. 9). The clay is firm but not fully consolidated and is being eroded in some of the creek beds. Large areas of these clays are present beneath swampy ground around the head of Lake Salome and the NE corner of Lake Ball, across the large wetland area at Zion Gate under Mt Jerusalem, and along the creek lines draining north and south from the saddles at Jaffa and Damascus gates. Surprisingly perhaps, the clay is also present on the saddles at Damascus and Jaffa gates. The clay typically carries grassy to open vegetation, with Pencil Pines in a few places. The thickness of the clay is usually difficult to discern but varies from about a metre to more than 5 m. The clay can be seen to overlie bouldery moraine in some places and wraps around several large dolerite boulders just south of Damascus Gate. It is clearly overlain by the margin of the large composite mass flow unit below the eastern flank of The Temple (pl. 4), and by the prominent solifluction lobe near the Pool of Bethesda (pl. 3).

The few good exposures of the clays show horizontal colour banding on a scale of mm to several cm, with colours varying from cream to brown to grey/black. The darker layers appear to be peaty, although this was not examined in detail. Some sandy to pebbly layers are commonly present. Alternation of graded sandy layers, 3–5 cm thick, with silty/clayey layers 1–2 cm thick, is evident in some places, such as on the north side of Damascus Gate. These layers are suggestive of flow into a water body and might, in part, represent seasonal varves.

Most of the larger areas of clay are associated with existing lakes, or with silted up lakes, as at Zion Gate, under Mt Jerusalem. A large area of wetland/sedgeland here, some 300 m wide by 800 m long, extends well down Zion Vale, where the clays have covered or partially covered several low-end moraines. The area features numerous small ponds and is slowly being reclaimed by sedges and Pineapple Grass *Astelia alpina*. The clays also occupy an open valley within the large Pencil Pine forest south of The Temple (pl. 10), where a small "remnant" lake is still present, fed by an active stream from the Damascus Gate area. This stream has banks of clay at least 5 m deep just upstream of the lake, suggestive of flow into a water body at a higher level than the present small lake, which appears to be the remnant of a much larger water body now almost silted up.

The clay deposits do not seem to be directly related to the present stream activity and represent fine material washed out of the moraines and deposited along stream courses and in former lakes. These would have included ice-dammed

PLATE 9 – Bedded clay in creek bed below Dixons Kingdom Hut.

PLATE 10 – View west across small "hidden lake" on valley floor south of The Temple. A remnant of the original lake formed as the ice retreated. Creek feeding the lake enters via a spring mound centre left. Wailing Wall and Solomons Throne on skyline.

lakes, formed as the ice melted and retreated from the Walls valleys, probably multiple times. The clays on the saddles at Damascus Gate and Jaffa Gate are interpreted as lake deposits formed when ice on either side of these saddles dammed temporary lakes. This may have been at the maximum ice level during the Last Glacial Maximum, but the presence of some ground moraine across the saddles also (at least at Jaffa Gate, and probably beneath the clay at Damascus Gate) indicates that ice has overtopped these saddles, probably at several stages. The presence of mass-flow solifluction deposits overlying the clays at Jaffa Gate and near the Pool of Bethesda indicates the clays are not simply post-glacial deposits.

The screes

Dolerite scree deposits occur beneath the cliffs along the Wailing Wall, under Solomons Throne, along the West Wall to King Davids Peak, under Mt Jerusalem, and in several places along the southern extension of the East Wall. The

deposits range from almost completely unvegetated in some places (e.g., pl. 11), to mostly vegetated in others. There are also several occurrences of similar unvegetated angular material on The Temple, associated with the extensive blockfield deposits, and in patches above the West Wall and Solomons Throne. Surprisingly perhaps, there are no apparent screes under the cliffs of Mt Moriah. The scree deposits have not been examined in detail, but there is evidence to suggest that they may be complex and multi-aged.

Along the Wailing Wall, there is a puzzling alternation of lobes or patches of unvegetated "fresh" scree with zones of shrubby vegetation and grassy strips. Some of the vegetated material appears to be scree – possibly older than the unvegetated material – but some is moraine (with clay matrix), and some is planed-off sandstone outcrop. Vegetated moraine extends almost to the foot of the cliffs in one area.

Under Solomons Throne (pl. 10), modern scree blankets the slope above a subdued cliff of sandstone and shale which has a patchy veneer of (old?) moraine across it, with the modern scree coming over the top of both the moraine and the sandstone. A large, closed depression partly infilled with coarse scree lies just behind this sandstone cliff about 70 m south of the track up the Throne, possibly indicating an incipient large slide. Further to the NW, a low terrace of apparently older vegetated scree has been mapped below the modern scree. This terrace is overlapped by the modern scree just to the north.

The screes north of this, under West Wall and King Davids Peak (pl. 11), are the largest in the area, and appear to be still active. They were not examined in detail. There is a strong connection between fans of scree and "funnels" in the cliff line. The sub-vertical upper main cliffs form about two-thirds of the overall face, with the scree and some lower outcrops of dolerite forming the lower part at a slope angle of 20–30°. The base of the screes is a sharp, almost linear contact with ground moraine in this area, but whether this indicates they have been "clipped" by ice is uncertain. The deposits along the Wailing Wall and West Wall include older-looking vegetated scree as well as younger unvegetated deposits.

PLATE 11 – Northern part of West Wall showing prominent screes. Photo: D. Boyer

Two ages of scree were also identified under one of the southern buttresses south of the East Wall (fig. 2). The narrow strip of older material seen here is vegetated, more weathered looking, and coarser than the nearby younger scree.

COMMENTS ON THE GLACIAL HISTORY

Hannan and Colhoun (1991) made a relatively brief study of the glacial features at the Walls as part of a more regional study of the wider National Park area and gave some initial interpretations of the glacial history. They recognised the young moraines near the Pool of Siloam and considered that these were deposited by a small lobe of Last Glacial Maximum Rowallan ice which entered from Zion Vale to the north. They thought that other such small lobes had entered at Zion Gate under Mt Jerusalem, and at Wild Dog Creek, in the next valley west of the Walls. It was considered that this ice had *not* flowed across the Gate of the Chain into the Lake Salome area because of the presence of "significant block stream development to the east of the col between the Temple and Zion Hill" (Hannan & Colhoun 1991, p. 4). It is not clear what this refers to, but it is probably the bouldery material here interpreted as washed moraine on the slopes of Zion Hill. They thought that the more prominent moraine ridges near the Pool of Bethesda were probably remnants from the Arm Glaciation and suggested that the deep clay "soils" seen at Lake Salome (the lacustrine clays of this investigation) represented "soil formation not found in areas known to have been glaciated by Rowallan age ice".

The present study shows that ice has occupied all of this area, including the Gate of the Chain col, and deposited significant amounts of till, but is not able to distinguish between the most recent ice event (Rowallan) and previous events. The small arcuate moraines near the Pool of Siloam may be recent, but most of the other moraine ridges appear to have been overridden and smoothed off by ice. There are no obvious retreat/end moraines in the Vale of Bethesda between Lake Salome and the Pool of Bethesda, suggesting that the recent ice in this area may have decayed without depositing moraines. There are curved end moraines in the Valley of Hinom, under Mt Jerusalem, but these also have an overridden smoothed-off appearance. This may imply that the most recent ice did not carry sufficient debris to produce end moraines.

Hannan and Colhoun suggested that Rowallan ice had entered the southern valley via Lake Ball, and that the NE-trending moraines in this area might reflect lineaments in the underlying ice-eroded landscape inherited from the Arm Glaciation. Again, the moraine forms in this valley have an overridden smoothed-off appearance, suggesting they may not have been deposited by the most recent ice event.

The presence of screes within the Walls was given considerable weight by Hannan and Colhoun. They believed that the "thick coarse screes" at the base of the West Wall and East Wall "were developed over a long time and are therefore unlikely to have been formed since the decay of the Rowallan ice" (Hannan & Colhoun 1991, p. 4). The present study indicates that some of the screes are certainly

recent, but that more than one age of screes is present. Some younger scree overlaps the moraine deposits, some has been impacted by ice to form a mixed deposit, and some is older and more weathered, and appears to pre-date at least some of the moraine.

Hannan and Colhoun concluded that the Arm Glaciation had probably covered most of the Walls area, with the possible exception of the higher parts of the West Wall, while the less extensive younger Rowallan Glaciation had left an uncovered "window" encompassing Mt Jerusalem, The Temple, Lake Salome valley, West Wall, East Wall, Mt Ophel, Zion Hill and the Solomons Jewels area. The present study shows that ice of Rowallan age occupied most of the Walls valleys and a large part of The Temple, but determination of the ice limits during different glacial stages must await further studies and dating in particular.

General nature of ice movement at the Walls

The mapped extent of glacial deposits, and the plot of the moraine ridges, allows the general nature of ice movement during the most recent glacial stages to be reconstructed (fig. 3). The older, more extensive stages would have involved continuous ice cover across all valleys and overriding of The Temple and higher areas, except for the small unglaciated area at Solomons Throne, but the last glaciation seems to have involved the valleys only. The plot of the ridges for the southern valley (fig. 2) clearly suggests that ice entered this valley from the southern (Lake Ball) end, and reached the flanks of The Temple, before the ice front retreated over the same ground. At some stage, this ice has reached almost to the top of The Temple and deposited the large "humps" of moraine on its southern flank. The most recent ice may have moulded these moraine humps at a lower level, along the scalloped surface, perhaps during retreat.

As the ice retreated from saddle level, there may have been several "still-stands" (or "slow-downs") when temporary ice-dammed lakes were formed, as the level dropped down the gentle slope of the valley. Larger lakes formed on the drainage from Damascus Gate and below Dixons Kingdom hut on the drainage from Jaffa Gate. Lake Ball was the final part of this retreat process. Clays washed from the upper slopes of moraine partly filled these lakes, and this process has continued slowly. The abundance of lacustrine clays is probably a function of the confined nature of the ice, which had to retreat over the same ground, forming lakes and promoting deposition of the eroding clay as it did so.

The northern valley presents a different picture, with ice entering from the NE corner (Zion Gate), and possibly over the low divide south of Mt Jerusalem, and exiting via the narrow outlet at Herods Gate (and probably over the nearby low part of Mt Ophel). This ice appears to have pushed part way up the north flank of The Temple and around into the second valley in the vicinity of the Pool of Bethesda, before exiting. The NW-oriented moraines in the Pool of Bethesda area are more suggestive of lateral moraines, with no clear examples of end moraines in the Damascus Gate area. Some of this ice entered and retreated from the narrow valley of Ephraims Gate, above the Pool

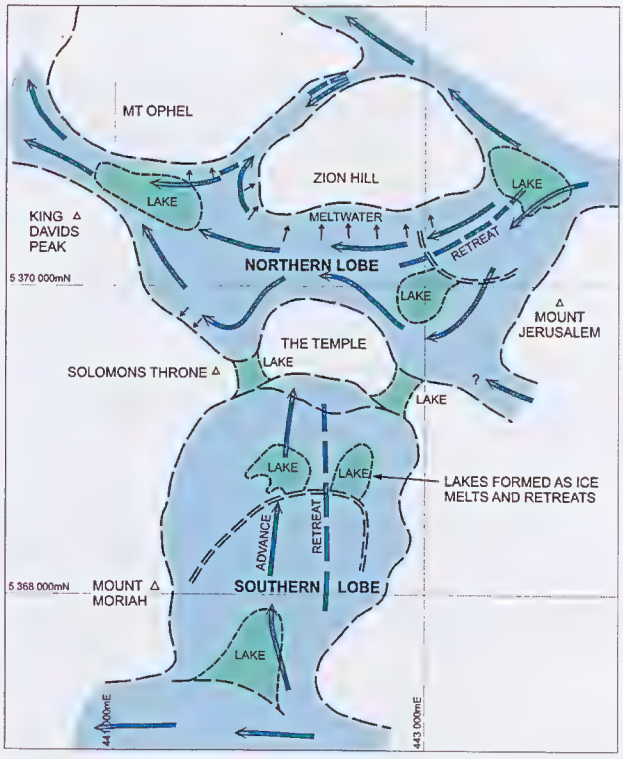

FIG. 3 – Preliminary reconstruction of ice movement and behaviour during the younger glaciations at the Walls of Jerusalem. Separate lobes of ice enter the Walls from north and south. Lakes are formed as the ice retreats.

of Siloam, as indicated by the set of end moraines. Ice also entered the northern part of this valley from the Zion Vale area, as indicated by a series of northwards-concave end moraines. The ice between The Temple and Zion Hill probably sloped to the north, such that meltwater runoff along the northern margin caused washing of the morainal material to produce the matrix-free boulder deposits seen along this edge.

Several temporary lakes were formed as this northern ice retreated, including one in the Valley of Hinom, and larger ones at Lake Salome and Zion Gate. These received much clay material washed in following ice retreat and have been slowly silting up and diminishing in size since. Small lakes also formed at the saddles between the northern and southern ice lobes, at Damascus and Jaffa gates, as evidenced by the presence of lacustrine clays.

DISCUSSION AND CONCLUSIONS

The Walls of Jerusalem are located on a raised horst of dolerite of the order of 100 m higher than the surrounding plateau, bounded by NW-trending regional faults. How the valleys of the Walls were formed is less clear, as the presence of Triassic sandstone in a number of places suggest that nearly all of the dolerite has been removed down to the level of the sandstone. Intense fracturing and jointing of a relatively thin part of the dolerite sill might account for this, as indicated by the highly fractured and fragmented nature of the remaining section at The Temple.

Ice has obviously overridden and abraded all the high points and escarpments in the area except for an extraordinary patch of about 18 ha at Solomons Throne, where irregular piles of blocky scree coloured red with lichen have not been glaciated. This high-level abrasion most probably relates to an earlier period of major ice cap development.

Ground moraine, probably mostly related to the most recent glaciations, covers virtually all the valley floors. It is mostly in the form of smoothed-off low ridges of clay-rich bouldery till, but also includes significant areas of matrix-free boulder deposits thought to be where meltwater running off the ice has washed the till. This requires further investigation.

Extensive areas of clays seem to mark the locations of lakes formed as the ice retreated from the valleys, and of streams feeding these lakes. Some of these lakes persist, including Lake Salome, Lake Ball, and a small lake south of The Temple, but others have silted up, and this process continues. The Temple is largely covered by periglacial deposits, with only small remnants of bedrock, and could be regarded as a showcase of such deposits for the Tasmanian dolerite country. Blockstream/solifluction flows of dolerite and clay with bulbous ends are very well displayed, and a large composite flow, which is rich in sandstone debris, has a well-exposed lobate toe. These flows appear to mostly overlie, and post-date, the lacustrine clays and ground moraine.

Dolerite screes occur along most of the escarpments and are particularly well developed along the West Wall and under Mt Jerusalem. Much of the scree appears to post-date the moraine deposits, but there are examples where the moraine partly incorporates scree, and where an older, more weathered scree may pre-date some moraine. There is much scope for detailed examination of the screes and indeed of all the glacial and periglacial deposits.

The lack of dates on any of the deposits, and the complex overlapping nature of the deposits and landforms, makes it impossible to accurately reconstruct the glacial history at this stage. It is most likely that deposits and landforms from both the Rowallan Glaciation of the LGM MIS2 and older deposits of the Arm Glaciation of MIS6 are present within the Walls. Hannan and Colhoun (1991) report a radiocarbon date of 8270 + 270 years BP from 2 m depth in a Sphagnum bog in "Zion Vale below Mt Jerusalem" (Whinam *et al.* 1989, p. 14). This suggests that these clays have continued accumulating since ice melted from the area well over 13 000 years ago.

The Walls of Jerusalem is an extraordinary place in many respects, and this study, possibly the first moderately detailed one to be undertaken there, has found considerable complexity and interest in the geology and geomorphology. Further study is required and recommended, including of its vegetation, fire history and Aboriginal occupation as well.

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SPORULATING MYCELIUM OF *DAVIDSONIELLA AUSTRALIS* ON THE BARK OF *NOTHOFAGUS CUNNINGHAMII*, AND ROLE AS INOCULUM FOR NEW INFECTIONS

by Glen A. Kile and Malcolm F. Hall

(with three tables and one plate)

Kile, G.A. & Hall, M.F. 2021 (15:xii): Sporulating mycelium of *Davidsoniella australis* on the bark of *Nothofagus cunninghamii*, and role as inoculum for new infections. *Papers and Proceedings of the Royal Society of Tasmania* 2021(2): 129–134. ISSN 0080-4703. 44 Hartington Street, Elsternwick, Victoria 3185, Australia. (GAK* and MFH). *Author for correspondence. Email: gkile@bigpond.net.au

Sporulating mycelial mats on the bark of lower stems are a common and notable sign of *Davidsoniella australis* infection of *Nothofagus cunninghamii* in cool temperate rainforest in Tasmania and Victoria. Inoculation studies indicate viable conidia from mats may be present in the rainforest during most of the year. Air- or water-borne conidia from sporulating mats and in the frass of the ambrosia beetle *Platypus subgranosus* that attacks infected trees, is the likely source of new infections in *N. cunninghamii*.

Key Words: ***Davidsoniella australis, Nothofagus cunninghamii*, mycelial mats, inoculum.**

INTRODUCTION

Davidsoniella australis (J. Walker & Kile) Z.W. de Beer, T. A. Duong & M.J. Wingf. (Basionym *Chalara australis* J. Walker & Kile) causes mortality of the cool temperate rainforest tree *Nothofagus cunninghamii* (Hook.) Oerst. (Myrtle Beech) in Tasmania and Victoria (Kile & Walker 1987). Cumulative tree mortality ranged from 9.4% to 53.4% in the stands surveyed by Elliott *et al.* (1987). The disease symptoms in individual infected trees include wilting of the crowns and dark brown discolouration of the outer wood of the mid- to lower stems and roots. The disease is regarded as an important element in rainforest regeneration and replacement (Packham *et al.* 2008).

D. australis may develop on the outer bark of the lower stems of infected trees initially as patches of dark grey to black sporulating mycelium (hereafter called mycelial mats) external to the underlying infected xylem tissue (Kile & Walker 1987). After sporulation, the residual black mycelium remains evident on the bark. Mycelial mats may also develop on the cut surfaces of recently infected trees or on other freshly exposed wood surfaces in the forest (Kile & Walker 1987, Kile 1989).

The ambrosia beetle *Platypus subgranosus* Schedl attacks the stems and exposed roots of infected trees although it is not a vector of the pathogen (Kile & Hall 1988). Viable conidia of *D. australis* occur in the frass of *P. subgranosus* from infected trees as the fungus sporulates in the beetle tunnels in infected wood (Kile & Hall 1988), and frass is also commonly dispersed over the mycelial mats. Wounds to *N. cunninghamii* stems from falling trees and branches are the probable infection courts (Kile & Walker 1987, Kile & Hall 1988, Kile *et al.*1989).

Mycelial mats are the most conspicuous reproductive stage of the fungus in nature and hence a potential source of inoculum for new infections. The incidence of mycelial mats and their potential as an inoculum source was assessed on naturally infected and artificially inoculated *N. cunninghamii* in Tasmania.

MATERIALS AND METHODS

The presence or absence of mycelial mats on *N. cunninghamii* naturally infected by *D. australis* was assessed as part of the survey of disease occurrence in relation to cool temperate rainforest subtypes and site and stand parameters undertaken by Elliott *et al.* (1987). The seasonal pattern of mycelial mat development was studied by inoculating 40-year-old trees of *N. cunninghamii* (tree age based on fire records) with *D. australis* in a stand in the Arve Valley, near Geeveston, Tasmania. Ten trees were inoculated once in autumn, winter and spring and summer by injecting 0.1 ml of conidial suspension (approximately ($5x10^6$ conidia per ml) into 3-mm-diameter by 25-mm-deep radial holes drilled around the stem circumference (one hole per cm of stem circumference) at 50 cm above ground level. The *D. australis* isolate (DAR 50148) was from an infected tree in a nearby location and the conidial suspension was prepared as described in Kile & Walker (1987).

Mycelial mat development was assessed on inoculated trees at 2–4-week intervals for six months following inoculation and at more irregular intervals for 6–18 months after inoculation. The maximum height above the inoculation zone at which mats developed and the proportion of the stem circumference around which mats developed was measured and the area of stem on which mats developed estimated in 25% of classes.

The viability of conidia from mycelial mats on inoculated trees was tested by taking bark samples (approx. 2 x 1 cm) from the margin of the mat. A small section was examined microscopically to assess for the presence of phialides and

conidia. The residual material was placed in 5 ml of a 3% malt extract solution in a vial and rubbed with a glass rod to disperse conidia. After incubation at 20°C for 15–18 hours, the first 50–100 conidia encountered were scored for germination at 200x magnification. The rod-shaped conidia of *D. australis* were morphologically relatively distinctive from the spores of other organisms that contaminated ageing mats. Where possible the same mats, or mats of approximately the same age and condition, were used for repeat sampling.

RESULTS

Mycelial mats occurred on 38% of *D. australis*-killed trees estimated to have been dead less than three years in the survey of Elliott *et al.* (1987). The extent of mats varied but the majority developed on the lower stems (up to 1.0–1.5 m above ground level) and exposed roots but sometimes occurred up to 3–4 m above ground level (pl. 1). The proportion of trees with mats was independent of tree diameter (table 1) but there was a significant orientation effect with a greater number of trees having the major extent of mats on the south side of the stems ($X^2 = 45.5$, $p < .001$) irrespective of tree diameter class. There was no significant difference in mat occurrence between the rainforest subtypes surveyed by Elliott *et al.* (1987).

Mycelial mats were frequent and extensive on artificially inoculated trees and were typically initiated around the full circumferential inoculation zone but later developed above and below that zone. Mat development showed a seasonal pattern with the most extensive and protracted development occurring on autumn-inoculated trees (table 2). The time to mat initiation was similar for autumn and spring inoculations and marginally longer in winter and summer.

The pattern of mycelial mat development was similar for all seasons of inoculation: an incubation period (7–12 weeks); mat initiation (usually on still living trees); expansion and cessation of mat development; some further development of mats during the next autumn period particularly after summer inoculation (table 2). Height of mat development on stems was less than the height of *D. australis* discolouration within the stems shown when dead trees were felled and crosscut. There was no orientation effect on mat development in the inoculated trees.

Newly developed mycelial mats emitted the characteristic iso-butyl acetate aroma of *D. australis* cultures (Kile *et al.* 1992). The aroma was relatively transient being detectable by nose in the first 1–3 weeks of mat initiation and expansion and most notable following autumn inoculation given the extensive mat development (table 2). No insect species were consistently associated with mats. On some trees that died following autumn, winter and spring inoculation, *P. subgranosus* attack occurred on the stems in the following summer but this was not specifically associated with mats.

PLATE 1 – Black mycelial mats of *Davidsoniella australis* and frass of *Platypus subgranosus* on the exposed roots and stem of naurally infected *Nothofagus cunninghamii*. (Photo: CSIRO Inc.)

TABLE 1 – Occurrence and major orientation of mycelial mats of *Davidsoniella australis* on the stems of 190 *Nothofagus cunninghamii* estimated to have been dead less than three years in 16 rainforest stands in Tasmania

Diameter range (cm)	No. trees	Percentage with mats	North*	East	South	West
15–35	50	32	1	2	13	0
36–55	49	49	4	3	15	2
56–75	37	43	4	1	9	2
76–95	25	36	1	5	3	0
96–115	18	22	1	1	1	1
> 115	11	57	2	0	2	0
Totals	190	$\bar{x}$=38	13	12	43	5

* Orientation of the major occurrence of mats.

Microscopic examination of mycelial mat samples showed abundant phialophores and conidia of *D. australis* on newly formed mats and especially around the margins of expanding mats. Numbers of phialophores and conidia diminished with ageing of the mats and exposure to rainfall and contamination by other microorganisms in the forest.

TABLE 2 — Mycelial mat development on the stems of *Nothofagus cunninghamii* inoculated with *Davidsoniella australis*

Season of inoculation	No trees with mats	Max. height of mats(cm) above inoculation zone	Estimated mat cover (%)*	Weeks to mat initiation	Main mat development period	No. trees killed	Ave. weeks to tree death
Autumn (March 1984)	9/10	68	50–75	7–10	April – Aug.	10	19 (12–41)
Winter (July 1984)	6/10	15	< 25	9–12	Sept. – Oct.	10	18 (17–26)
Spring (Nov. 1984)	6/10	41	< 25	6–9	Dec. – mid-Jan.	10	11 (10–14)
Summer (Jan. 1985)	6/10	33	< 25	9–11	March- April and May to July	8	11 (6–11)

Note: Mean tree height 11.2 m, mean diameter at 1.3 m over bark 8.9 cm.
* Visual estimate of stem area with mats between the inoculation zone 50 cm above ground level and the maximum height of mats.

TABLE 3 – Average percentage germination of *Davidsoniella australis* conidia from mycelial mats initiated in different seasons on inoculated trees of *Nothofagus cunninghamii*

Season	May 1984	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan. 1985	Feb.	Mar.	Apr.	May	June
Autumn (n=5*) (March)	52# (14–74)	56 (16–94)	8 (1–15)	3 (0–12)	14 (0–46)	2.4 (0–8)	0							
Winter (n=2) (July)						27 (8–46)	5 (3–6)	0						
Spring (n=3) (Nov.)									28 (26–30)	8 (4–11)	2 (1–2)	0		
Summer (n=3) (Jan.)												13 (13)	22 (14–30)	6 (3–12)

* Number of trees from which mycelial mats were sampled.
#Average and range in the samples tested.

Viable conidia were present on mycelial mats formed after inoculation in all seasons (table 3) but with the natural exposure of mats, variability in the number of conidia and germination rate was very high and not amenable to statistical analysis. Viable conidia were present on mats formed following autumn inoculation for up to six months but the number and viability of conidia on mats formed after inoculation in other seasons declined rapidly (table 3).

DISCUSSION

The occurrence of mycelial mats of *D. australis* on naturally infected *N. cunninghamii* is concentrated on the lower stems and exposed roots and on the more shaded southern sides of the trees. Mats are a notable feature of the disease. The generally more profuse and more even circumferential development of mats on the inoculated trees probably results from the large well-distributed inoculum dose killing large volumes of host tissue relatively quickly.

In seasonal terms the most extensive and most protracted mycelial mat formation on inoculated trees occurred after autumn inoculation. Summer-inoculated trees also showed some further mat development during autumn. This suggests that temperature and moisture conditions during the autumn–early winter period were most conducive to growth of the pathogen through to the external surface of the bark from the infected tissue beneath. This contrasts with winter inoculation when time to tree death was similar to autumn and bark wetness would frequently be high but temperatures lower. Spring and summer inoculation resulted in the most rapid tree death, but it is likely higher temperatures and more rapid drying of the bark restricted mat formation.

Other pathogenic species that cause similar vascular staining and tree wilt symptoms as *D. australis* may form

localised mycelial mats on infected trees or cut surfaces of infected tissue (see illustrated examples for *Ceratocystis fimbriata* in CABI (2020) and *C. albifundis* M. J. Morris, de Beer, M.J. Wingf. in Roux *et al.* 2007 and de Beer *et al.* 2014). *Bretziella fagacearum* (Bretz) Z.W. de Beer, Marinc. T.A. Duong & M.J. Wingf., the cause of oak wilt, forms distinctive mycelial mats beneath the bark of infected trees that leads to bark cracking and spore dispersal (Curl *et al.*1953). *D. australis* appears unique as an endemic pathogen in natural forests where mat formation is common and sometimes extensive on the bark of infected trees.

Mycelial mats produced viable conidia although the number and viability declined quickly for spring, winter and summer inoculation. In autumn, the ongoing development of mats over several months resulted in higher conidial viability for longer, although variability was high due to the exposure to the natural environment. The seasonal pattern of mat development in natural forest is unknown but in recently infected trees could be expected to respond to the seemingly favourable environmental conditions in the autumn–early winter evident in the artificially inoculated trees.

Mycelial mats are the most conspicuous reproductive phase of *D. australis* known in nature, although viable conidia are found particularly in the adult frass from *P. subgranosus* attack in infected trees (Kile & Hall 1988). These conidia come from sporulation of the fungus in the beetle tunnels in the host with conidia expelled with the frass but also potentially frass contact with sporulating mats. The results from artificial inoculation and frass studies (Kile & Hall 1988) suggest the potential for viable conidia of *D. australis* to be present in rainforest for much of the year from mats and frass, the quantum depending on the number and status of infected and dying trees. Conidia and ascospores of species such as *B. fagacearum* and *Hymenoscyphus fraxineus* (T. Kowalski) Baral, Queloz, Hosoya are dispersed by wind (Curl 1955, Timmermann *et al.* 2011). Given the often wet and windy environment of the Tasmanian rainforest, both wind and water are likely to be important for *D. australis* dispersal.

Infection of fresh billets of stem wood of *N. cunninghamii* exposed in the rainforest occurred at any time of the year although with a winter minimum and summer–autumn peak (Kile *et al.*1989). This suggests a maximum inoculum load during spring to autumn, potentially from a combination of conidia from mats and from frass. It is impossible to readily determine the contribution of conidia disseminated from mats and conidia transferred with frass to the initiation of new infections. However, not all trees produce mycelial mats but all infected trees are attacked by *P subgranosus*. Given fresh frass is likely readily carried in air or water, transfer of conidia in frass may be the more important source of inoculum for new infections. In this respect the disease cycle appears similar to that of the wilt disease of Cacao *Theobroma cacao* L. caused by *Cerotocystis cacaofunesta* Engelbrecht & Harrington where pathogen-contaminated frass was considered the main means of spread but where, unlike *D. australis*, there was little external sporulation of the pathogen (Iton 1960).

Davidsoniella australis spreads below ground via root grafts leading to the development of clumps of dead and dying trees (Elliott *et al.* 1987, Packham 1994). The ready infection through the seasons of fresh exposed sections of *N. cunninghamii* in rainforest (Kile *et al.*1989), the natural infection in different seasons of artificial wounds in *N. cunninghamii* (Kile & Walker 1987, Packham 1994) and the rapid development of disease in disturbed areas (logging, thinning, roading) of *N. cunninghamii*-rich rainforest where the likelihood of wounding of the residual or bordering *N. cunninghamii* is increased (Packham 1994, Elliott *et al.* 2005), indicates suitable tree wounds and air- or water-borne inoculum from mycelial mats and frass is the source of new above-ground infections of *N. cunninghamii* in the rainforest.

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WHAT'S IN A NAME? *POLYZOSTERIA YINGINA*; THE GOLDEN SUN COCKROACH

by Shasta C. Henry

(with one text-figure and three plates)

Henry, S.C. 2021 (15:xii): What's in a name? *Polyzosteria yingina*; the Golden Sun Cockroach. *Papers and Proceedings of the Royal Society of Tasmania* 155(2): 135–138. ISSN: 0080-4703. School of Geography, Planning, and Spatial Sciences, University of Tasmania, Private Bag 78, Hobart, Tasmania 7001, Australia. Email: Shasta.Henry@utas.edu.au

The endemic Tasmanian cockroach *Polyzosteria yingina*, was formally described in 2021, 80 years after it was first documented. Evidence from morphology, biogeography and DNA barcodes distinguishes this species from the related mainland Australian taxa it had previously been confused with and united the geographically disparate alpine and coastal populations under a single specific epithet. That specific epithet, *yingina*, was chosen in collaboration with the Tasmanian Aboriginal Centre. This was to acknowledge that, given the species' large size, handsome appearance and overt behaviours, it would once have had Aboriginal names, which now may have been lost due to colonial disruption of language, land and culture.
Key Words: *Polyzosteria yingina*, taxonomy, molecular biogeography, *palawa kani*.

INTRODUCTION

Taxonomic descriptions, like many other finely honed scientific tools, can be sterile and charmless. By necessity or convention, they remove the many human details of choosing a name for a species, summarising the weighty decision as several sentences under 'Etymology', relegated to the very end of a description. This is in stark contrast to our sense of importance and appreciation for the meaning of names. That we have spent 200 years, laboriously naming only one tenth of the global biodiversity without resorting to randomly generated numbers is a testament to our attachment to names. Language and its meaning are potent.

Many species' scientific names serve as a monument to a scientist's legacy, such as the many species named in honour of Charles Darwin. Of the Northern Australian Darwin Toadfish, originally named *Tetrodon darwinii,* Castelnau wrote 'Dedicated to the greatest naturalist of the age' (Castelnau 1873, p. 95). A cryptic Tasmanian *Oenochroma* moth which went unnoticed as a separate species until 2009 was given the specific epithet of *barcodificata* to acknowledge the technological advancement which made its detection possible (Hausmann *et al.* 2009). A tiny Western American moth species *Neopalpa donaldtrumpi* Nazari (2017) was named to leverage its quiff of blonde scales (akin to the hairdo of the infamous 45th President of the United States) into international notoriety. While this example may lack the honorific of those attributed to Darwin, Nazari's intention of garnering attention for biodiversity protection acknowledges the power of a 'name'.

In 2021, two years of research work closed a chapter in Tasmanian taxonomy which had previously been open for 80 years though possibly more than 10 000 years. This was the publication of a scientific species name for the endemic Tasmanian cockroach commonly known as the Golden Sun Cockroach, now formally as *Polyzosteria yingina* Henry. It is a very large insect for Tasmania and especially eye-catching with the colour and finish of hammered bronze (pl. 1). The species is active during the day, basking on the sand dunes of the east coast or feeding on alpine heath flowers around the Central Plateau lakes (Richards & Spencer 2019).

THE 80-YEAR STORY

It is unusual for such a conspicuous species to remain unnamed for so long (Gaston 1991), yet *P. yingina* appears to have actively evaded it. The oldest known specimen in collections was lodged at the Tasmanian Museum and Art Gallery (TMAG) in 1941. The entire genus was 'thoroughly' reviewed Australia-wide in 1965 by Josephine Mackerras who even described one putative new species based on a single

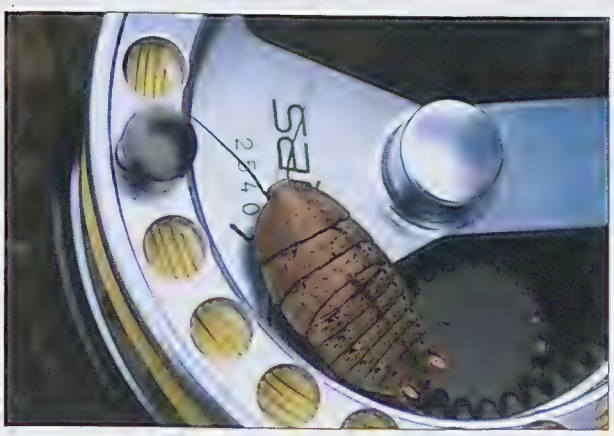

PLATE 1 – One of the public photographs of *P. yingina* published in Henry *et al.* (2021). A male specimen observed while the photographer was fishing at Christys Creek, Central Plateau, Tasmania, 41°52'16.09"S; 146°26'13.56"E; 1169 m asl; 24 Feb. 2011. Body length: 26–30 mm. Photo: Daniel Hackett

specimen. Therefore, it is assumed Mackerras was unaware of the Tasmanian specimen, to have not treated it the same way. The discovery of a male specimen in 1972 led to the species being mis-ascribed as *P. oculata* Tepper (core range is Kangaroo Island, SA) based solely on the examination of external features (Green 1973). As was later learned, the male genital assemblages of *P. oculata* and *P. yingina* are discernibly different, even when only consulting the illustrations of Mackerras (1965). Tasmanian researchers had studied the species' natural history in detail (Richards & Spencer 2019), even sending several specimens away for DNA barcoding in 2012 (Spencer & Richards 2012), which still produced no name. In 2019 the Australian Faunal Directory (https://biodiversity.org.au/afd/home) still listed *P. oculata* as the species occurring in Tasmania and due to online photograph and natural history databases, new misidentifications were disseminating. The Encyclopedia of Life (EOL) and thereby the Atlas of Living Australia, labelled specimens photographed in Tasmania as *P. viridissima* Shelford (core range within Kosciuszko National Park, Vic.) based on the clearly speculative identification of the photographer contributing to the EOL Flicker Group (https://eol.org/media/6790840).

These online photographs became a key aspect of this species' eventual identity. Like many other *Polyzosteria* cockroaches in Australia (Rentz 2014), *P. yingina* is not only a large, diurnal, strikingly coloured and active species but in Tasmania is locally abundant in low contiguous scrub in parts of the Central Highlands (Spencer & Richards 2012, Fearn & Maynard pers. comm.), as well as hundreds of kilometres away on Tasmania's eastern beaches. As such, many people are familiar with the species; so much so, the catalogue of specimen records was increased by 30% through the contribution of photographs from repositories such as Facebook, Instagram and Flickr (Henry *et al.* 2021). Fishers who frequent the Central Highlands refer to cockroach bait (Rist 2009) for 'roach-fishing' and have a fly-tie based on this species (Hackett pers. comm.). Fishers' regular sightings of the cockroaches floating in tarns and lakes also contributed to the 'rafting downstream from the Central Highlands to the coast' hypothesis which attempts to explain how Tasmania has two distant populations which are nevertheless genetically indistinct (Henry *et al.* 2021, although see Richards & Spencer (2019) for further conundrums). *Polyzosteria* cockroaches are so bold as to stand their ground when alarmed, exposing their brightly coloured terminalia and spraying a noxious smelling liquid if threatened (Mackerras 1965, Rentz 2014, Richards & Spencer 2019). One specimen label in the Queen Victoria Museum and Art Gallery (QVMAG) collection recounts how the cockroach was collected from a home in Scamander after 'nearly blinding a dog pursuing it' (pl. 2).

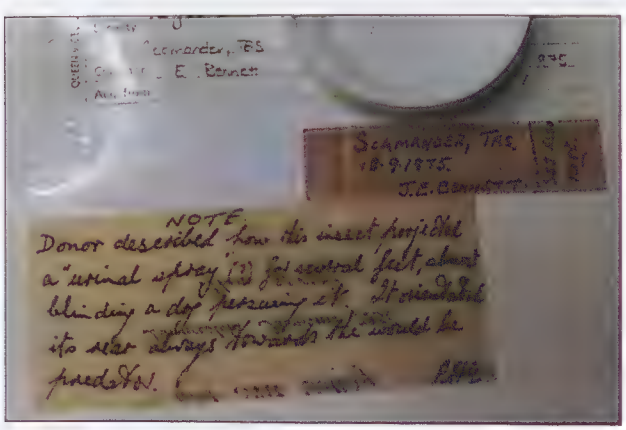

PLATE 2 – This handwritten account accompanying the *P. yingina* specimen QVM:2015:12:1499 from Scamander is one of few records of the Tasmanian species actively spraying in defence as other *Polyzosteria* are known to do.

THE 10 000-YEAR STORY

Polyzosteria cockroaches are apterous, meaning wingless. As they cannot fly and are most abundant and speciose on mainland Australia, it is assumed they have been isolated in Tasmania for at least 10 000 years when the ending ice age flooded the Bassian Plain creating Bass Strait. During this long period of isolation, the Tasmanian species evolved a unique set of physical features and hence unique genetic barcode enabling it to be more easily distinguish from related species (Henry et al. 2021, pl. 3), yet ironically, we know the least about this longest period of its history. As indigenous names often convey knowledge about form, use, distribution and ecology (Gillman & Wright 2020), if Tasmanian Aboriginal languages had been better preserved, we might know more about this species than we do today, not least its traditional name/s. Over thousands of years of cohabitation, such an obvious species would certainly have attracted the attention of Aboriginal people in the same way that it is known to local communities now. Therefore, in 2019 choosing a specific epithet for this cockroach was deferred to the Tasmanian Aboriginal Council *palawa kani* Language Program.

This is not the first time that Tasmanian Aboriginal words have fulfilled the taxonomic tradition of type locations being used as specific epithets ('tarkinensis' Shear & Mesibov 1995, 'kunanyia' Byrne & Wei 2012) nor the first time they have been used expressly for the inclusion of Aboriginal language. Taxonomist L.E. Couchman has left a significant legacy of intentionally ascribing Tasmanian insect species Aboriginal names (Couchman 1953, 1965). The use of 'truganini' for naming species (e.g., Monrós 1958, Slater & Sweet 1970, Moore 1981, Key 1991, Shear & Mesibov 1995, Mesibov 2003, Schmidt & New 2008) may appear unambiguously honorific. However the previously noted brevity of naming rationale mean that Monros' reason for naming Tasmanian species *Microdonacia truganina* (from his home in Germany, 1958), is not included in the manuscript, and Slater & and Sweet's (1970, p. 292) etymological statement "We take pleasure in naming this species (*Tasmanicola truganinae*) after the last Tasmanian Aborigine to survive" is made less clear by its historical context; the paper was published in apartheid era South Africa. Schmidt and New show how simple clarity can be, of *Ptycta pallawahensis* the authors wrote "In reference to pallawah, an indigenous term of self-reference, and the former name of the type locality prior to it being named

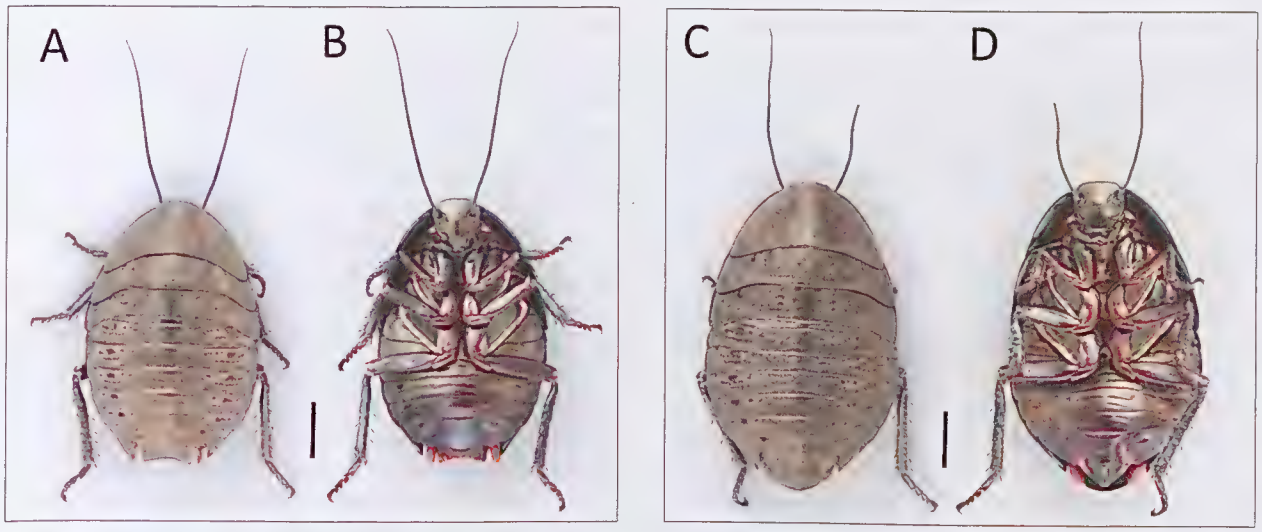

PLATE 3 – *Polyzosteria yingina* photo paratypes from Henry *et al.* (2021). **A, B** Male TMAG: F13361. **C, D** Female TMAG: F13354. **A, C** dorsal view. **B, D** ventral view. Scale bars 5 mm.

Daisy Dell" (Schmidt & New 2008, p. 141). While the motivation for ascribing Aboriginal names are the authors own, the question arises as to whether the Indigenous community is ever consulted, or even alerted to their existence? The policy preamble for the Aboriginal Dual Naming of Tasmanian geographic places states that while some contemporary Tasmanian place names are based on the names used by Tasmanian Aboriginal people, they are often based on European interpretation and were co-opted without consent (ADNP 2019).

There is a discord in the distribution of global biodiversity and taxonomy. Most new species described are from the global south in publications from the global north (DuBay et al. 2020, Giangrande 2003). Therefore, thousands of equatorial species have been ascribed their scientific name in a language foreign to the country of origin. The type-specimen of the Australian Botany Bay Weevil (*Chrysolopus spectabilis*) for example was collected in 1770 by Sir Joseph Banks, described in Latin and stored along with other Australian and New Zealand (Aotearoa) type-specimens in the London Natural History Museum (Radford 1981). Following this scientific protocol, many natural history specimens have become alienated from the communities who live with the organisms themselves which is now considered an environmental injustice (Ritvo, 1990).

> palawa kani *means 'Tasmanian Aborigines speak'; it is the only Aboriginal language in lutruwita (Tasmania) today. Between 8 and 16 separate languages could have been spoken here originally; we will never really know. Some tribes had been wiped out by contact sicknesses even before full scale invasion and the languages continued to die away with the people. Fortunately, remnants of many of those original languages were written down in wordlists by more than twenty different European recorders and some phrases, sentences and songs remembered by Aboriginal people. Tragically, there aren't enough words or information recorded of any of the original languages to rebuild any one of them exactly as it was. As a result,* palawa kani *combines words retrieved from as many of the original languages as possible. After two decades, Aboriginal people of all ages can now speak* palawa kani, *the language of Tasmanian Aborigines, and children learn it from an early age.* (TAC 2021)

In the absence of a recorded Aboriginal name matching this species' description – although there no doubt would have been one (Annie Reynolds, Co-Ordinator *palawa kani* Language Program 2019, pers. comm.) *Polyzisteria yingina* shares the *palawa kani* name of the Great Lake 'yingina' which is the eastern boundary of this species' alpine distribution (fig. 1). 'This specific name was chosen in collaboration with the Tasmanian Aboriginal Centre; acknowledging that given the species' size and diurnal habits, it would once have had an Aboriginal name, one which has been lost due to colonial disruption of Aboriginal land, culture and language' (from *P. yingina* 'Etymology' in Henry *et al.* 2021, p. 395).

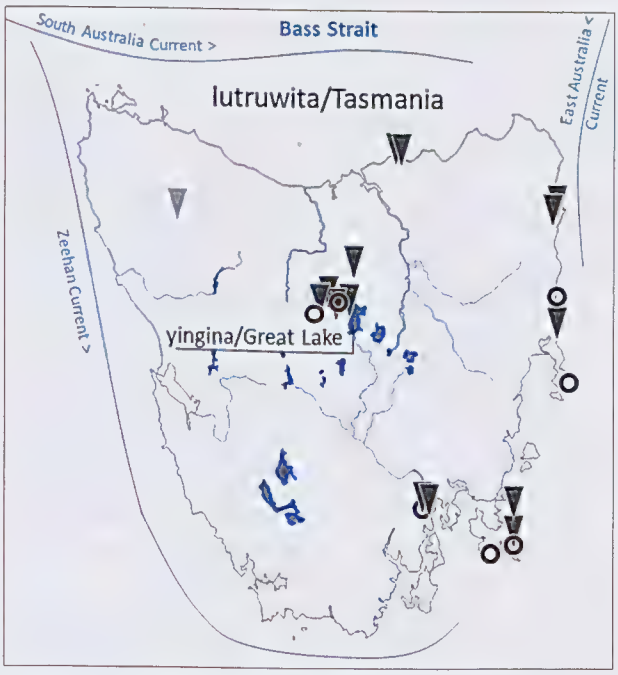

FIGURE 1 – Distribution map of *Polyzosteria yingina* in Tasmania, Australia; *palawa kani* dual place names are used. Triangles indicate physical specimen locations; circles indicate verifiable photographs (all location data in Henry *et al.* 2021).

A specific epithet can act as an honorific due to our sense of the importance of names. However due to demographic imbalance the way taxonomists have traditionally chosen to honour people reflects this inherent bias (Pillon 2021). By sharing the responsibility of naming species, taxonomists may better share the associated sense of ownership with traditional owners (Hágsater & Wrazidlo, 2020). Just as Tasmania recently established a framework to restore Aboriginal place names (ADNP 2019), more taxonomists are advocating for the de-colonisation of science nomenclature in favour of more representation of Indigenous languages (Gillman & Wright 2020). The revival of Tasmanian Aboriginal language is creating the dual resources of more written words for inclusion in the scientific literature and a groundswell of speakers and scholars who can be consulted about the use of their language.

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(accepted 29 September 2021)

TASMANIAN MUSEUM AND ART GALLERY'S EXPEDITION OF DISCOVERY III – THE FLORA AND FAUNA OF THE SPRING BAY MILL AREA AFTER A LONG HISTORY OF INDUSTRIAL USE

by Matthew L. Baker, Miguel F. de Salas, Simon Grove, Lynette Cave, Kirrily Moore, Catherine Byrne, E. Lee and Gintaras Kantvilas

(with one text-figure, seven plates, three tables and one appendix)

Baker, M.L., de Salas, M.F., Grove, S., Cave, L., Moore, K., Byrne, C., Lee, E. & Kantvilas, G. 2021 (15:xii): Tasmanian Museum and Art Gallery's Expedition of Discovery III – The flora and fauna of the Spring Bay Mill area after a long history of industrial use. *Papers and Proceedings of the Royal Society of Tasmania* 155(2): 139–162. ISSN 0080-4703. Tasmanian Museum and Art Gallery, GPO Box 1164, Hobart, Tasmania 7001, Australia (MLB*, MFS, SG, LC, KM, CB, EL, GK). *Author for correspondence. Email: matthew.baker@tmag.tas.gov.au

Flora and fauna surveys were conducted at the Spring Bay Mill property and adjacent area near Triabunna in 2019 as part of the Tasmanian Museum and Art Gallery's ongoing research, collection-building and nature-discovery program entitled *Expeditions of Discovery*. Although a large portion of the mill site has experienced significant disturbance, some bushland remnants on the property and the adjacent coastal reserve remain in very good ecological condition and are refugia for species now lost from the wider landscape. The survey recorded 1088 taxa, principally from the targeted groups of vascular plants, bryophytes, lichens, beetles, butterflies and moths, with several of the taxa, chiefly lichens and invertebrates, either new to science or new records for Tasmania. The survey expands our knowledge of the flora and fauna of the Triabunna area and serves as a baseline for a property undergoing strategic rehabilitation after a long history of industrial use.
Key Words: species discovery, biodiversity, Tasmania, multidisciplinary survey, Triabunna, Spring Bay Mill.

INTRODUCTION

The Tasmanian Museum and Art Gallery's (TMAG) expedition to the Spring Bay Mill property was the third in a series of multidisciplinary biological surveys conducted under the banner of its *Expeditions of Discovery*. The aims and rationale for the surveys, as discussed by Baker *et al.* (2019), are to: build TMAG's collections of flora and fauna from poorly sampled areas of Tasmania; document the species of plants and animals present; discover new or hitherto overlooked species; and highlight the role that baseline species-discovery research plays in understanding and managing Tasmania's biota. The first two expeditions in this series were conducted at the *Wind Song* property at Little Swanport in 2017 (Baker *et al.* 2019), and the Musselroe Wind Farm at Cape Portland (Baker *et al.* 2021). Collectively, they have recorded approximately 2300 taxa, including several new to science or for Tasmania (McCarthy & Kantvilas 2018, Elix *et al.* 2019a, Elix *et al.* 2019b, Elix & Kantvilas 2020, Kantvilas 2021, Kantvilas *et al.* 2020, Kantvilas *et al.* 2021).

The Spring Bay Mill site provided a unique opportunity to focus on a part of Tasmania that had been previously poorly surveyed for flora and fauna, with very few vouchered collections held in museums and herbaria. Furthermore it enabled the establishment of a biological baseline for underpinning the long-term aim of the property owners to rehabilitate the site after decades of heavy industrial use. The survey focused on vascular plants, bryophytes, lichens, butterflies and moths, and beetles, with other taxonomic groups recorded opportunistically.

METHODS

The Spring Bay Mill property is located on Tasmania's east coast, approximately 5 km southeast of Triabunna (fig. 1). It is privately owned and managed as an events venue, having previously had a long history (*c.* 40 years) of industrial use as one of Tasmania's main woodchip mill and export sites. The property covers *c.* 40 ha and is bordered by approximately 1.7 km of reserved coastline and farmland (fig. 1). A large proportion of the property (~60 %) was previously cleared and consists of large buildings and hard surfaces. Despite this, some remnant patches of native vegetation with a diverse range of habitats still remain. The survey area is predominantly underlain by Triassic sandstone (Forsyth *et al.* 2005), which is exposed along the adjacent coastline.

The climate of eastern Tasmania corresponds to the Köppen classification of *Cfb* (temperate, warm summer, without dry season (Peel *et al.* 2007)). The nearest weather station to Spring Bay Mill is at Orford, approximately 5 km to the west, where average temperatures fluctuate from 3.6–13.1°C in winter to 12.1–22.2°C in summer. Modelling by Land Tasmania, following methods prescribed in Webb *et al.* (2015), suggests average minimum temperatures of 5.6–6.6°C for July and 12.7–13.3°C for January, with average maximum temperatures of 12.4–13.3°C in July and 21.5–21.7°C in January (LIST 2020). Mean monthly rainfall is relatively steady and varies between 44.5 mm and 64.9 mm, with an annual average of 667 mm (BOM 2020).

The property was surveyed from 18–22 November 2019, with follow-up invertebrate sampling and trap-sample

FIGURE 1 – Location of the Spring Bay Mill property showing main collecting locations and approximate reserve boundaries. 1 Freestone Cove, 2 Freestone Point, 3 Freestone Point (hinterland), 4 Freestone Point (west coast), 5 North West Corner, 6 Quiet Corner, 7 Cresponea Cliffs, 8 Glamping Glade.

collection on 18 December 2019, 15 January 2020 and 14 February 2020, and additional lichen sampling from 9–10 January 2021.

Sampling methods are described in previous accounts of TMAG expeditions (Baker *et al.* 2019, 2021) so are not repeated here. Sampling occurred throughout the property as well as in the adjacent coastal reserve. The main collecting localities are shown in figure 1 and listed in table 1. Additionally, the littoral and sublittoral zones were investigated by snorkelling and beach-walking, although only a few of the more prominent taxa were sampled or otherwise recorded. Identification was undertaken using standard equipment and techniques, with comparison to TMAG's reference collections when necessary. Lichens were identified in the laboratory using low-power and high-power microscopy of hand-cut sections of the thallus (vegetative tissue) and apothecia (reproductive structures), mounted in water, 10% KOH, 50% HNO3, lactophenol cotton blue, ammoniacal erythrosin and Lugol's iodine. Routine chemical analyses using thin-layer chromatography followed standard methods (Orange *et al.* 2010). Some moth specimens were identified using the reference collections of the Australian National Insect Collection (ANIC) (https://www.csiro.au/en/about/facilities-collections/collections/anic) and the Biosecurity Tasmania Insect Collection at the New Town Research Laboratories of the Department of Primary Industries, Parks, Water and Environment.

Vascular plant nomenclature follows de Salas and Baker (2021), common names follow Wapstra *et al.* (2005) and designated in capitals. Nomenclature for mosses and liverworts is in accordance with the Australian Moss Name Index (ABRS 2021a), the Checklist of Australian Liverworts and Hornworts (McCarthy 2006) and Tropicos (Tropicos.org. 2021). Lichen nomenclature mainly follows McCarthy (2020). Nomenclature of vertebrate and invertebrate taxa identified to species, follows the Australian Faunal Directory (ABRS 2021b).

Undescribed, partially identified or new species of insect are annotated with a unique epithet based on the registration number of an exemplar specimen from the TMAG collections, such as '*Euryglossa* sp. TMAG_F96120'. In cases where specimens can be associated with previously collected material, existing epithets are adopted. Insect specimens that could only be identified to a higher taxonomic rank than species are annotated with 'unplaced'. Moth distributions and rarity were determined, in part,

TABLE 1 – Main collecting localities at Spring Bay Mill

Site	Fig. 1 ref	Latitude	Longitude
Freestone Cove	1	42° 32' 44"S	147° 55' 56"N
Freestone Point	2	42° 33' 00"S	147° 55' 57"N
Freestone Point (hinterland)	3	42° 32' 57"S	147° 55' 58"N
Freestone Point (west coast)	4	42° 32' 58"S	147° 55' 55"N
North West Corner	5	42° 32' 31"S	147° 55' 54"N
Quiet Corner	6	42° 32' 47"S	147° 56' 18"N
Cresponea Cliffs	7	42° 32' 57"S	147° 56' 07"N
Glamping Glade	8	42° 32' 30"S	147° 56' 06"N

TABLE 2 – Overview of taxa recorded from Spring Bay Mill and surrounding coastal reserve

Group	Total taxa	Introduced species
Vascular Plants	144	39
Eudicots	90	24
Magnoliids	1	
Gymnosperms	1	
Monocotyledons	50	15
Pteridophytes	2	
Bryophytes	27	
Liverworts	4	
Mosses	23	1
Lichens	124	
Invertebrates – Lepidoptera	191	1
Invertebrates – Coleoptera	213	9
Invertebrates – Other Insects	279	3
Blattodea	4	
Dermaptera	1	
Diptera	122	2
Hemiptera	61	
Hymenoptera	70	1
Neuroptera	4	
Odonata	2	
Orthoptera	13	
Psocodea	1	
Thysanoptera	1	
Other Arthropods	9	3
Araneae	3	1
Crustacea (terrestrial)	1	1
Crustacea (marine)	5	1
Mollusca (terrestrial)	2	1
Mollusca (marine)	47	2
Bryozoa (marine)	12	2
Cnidaria (marine)	4	
Chordata: Tunicata (marine)	4	1
Vertebrates	32	5
Birds	31	5
Amphibians	1	
Total	1088	102

TABLE 3 – Putative insect novelties recorded from Spring Bay Mill and surrounding coastal reserve

Order	Family: Subfamily	Taxon	No. of specimens
Coleoptera	Meloidae	Nemognathini unplaced sp. TMAG_F101079	1
Coleoptera	Scarabaeidae	Melolonthinae unplaced sp. TMAG_F111109	1
Diptera	Pyrgotidae	*Adapsilia* sp. TMAG_F101464	1
Diptera	Therevidae	*Parapsilocephala* sp. TMAG_F100830	1
Hymenoptera	Mutillidae	*Ephutomorpha* sp. TMAG_F103101	1
Lepidoptera	Elachistidae: Elachistinae	*Elachista* sp. TMAG_F118015	1
Lepidoptera	Elachistidae: Elachistinae	*Elachista* sp. TMAG_F118016	1
Lepidoptera	Elachistidae: Elachistinae	*Elachista* sp. TMAG_F118018	1
Lepidoptera	Elachistidae: Elachistinae	*Elachista* sp. TMAG_F118019	1
Lepidoptera	Elachistidae: Elachistinae	*Elachista* sp. TMAG_F118020	2
Lepidoptera	Elachistidae: Elachistinae	*Elachista* sp. TMAG_F118022	1

PLATE 1 – North West Corner. White Gum *Eucalyptus viminalis* woodland over skeletal soils and sandstone rock plates.

PLATE 2 – Cresponea Cliffs. Sandstone cliffs dominated by *Allocasuarina verticillata* forest.

PLATE 3 – Oyster Bay Pine *Callitris rhomboidea* woodland on sandstone.

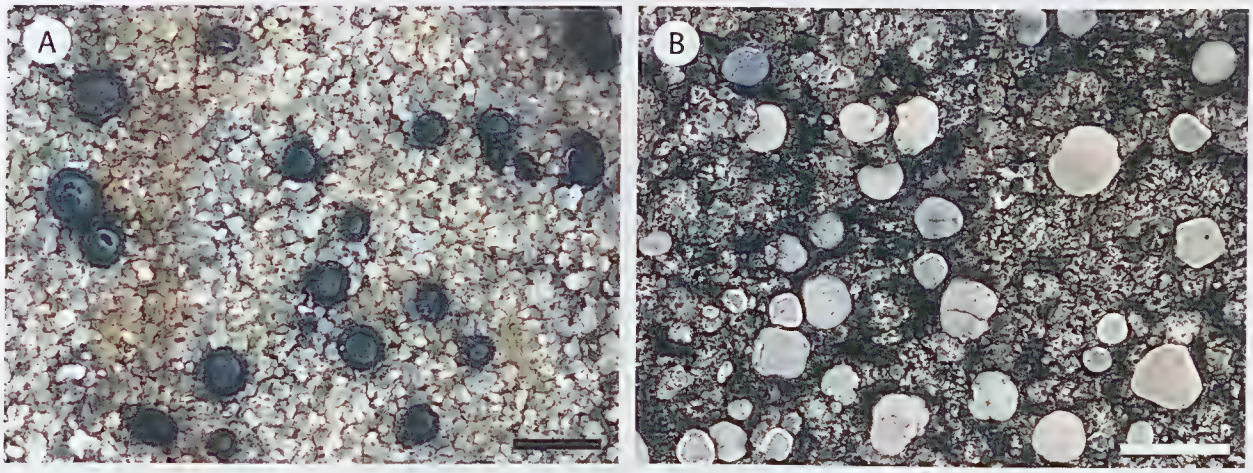


PLATE 4 – New lichen species discovered at Spring Bay Mill. **A.** *Creponea graemeannae* with black apothecia scattered over boulders of coarse sandstone; **B.** *Cliostomum* sp. with pale greyish apothecia on seashore sandstone. Scales = 2 mm.

by referring to specimens in ANIC. Species with official common names are designated in capitals.

RESULTS

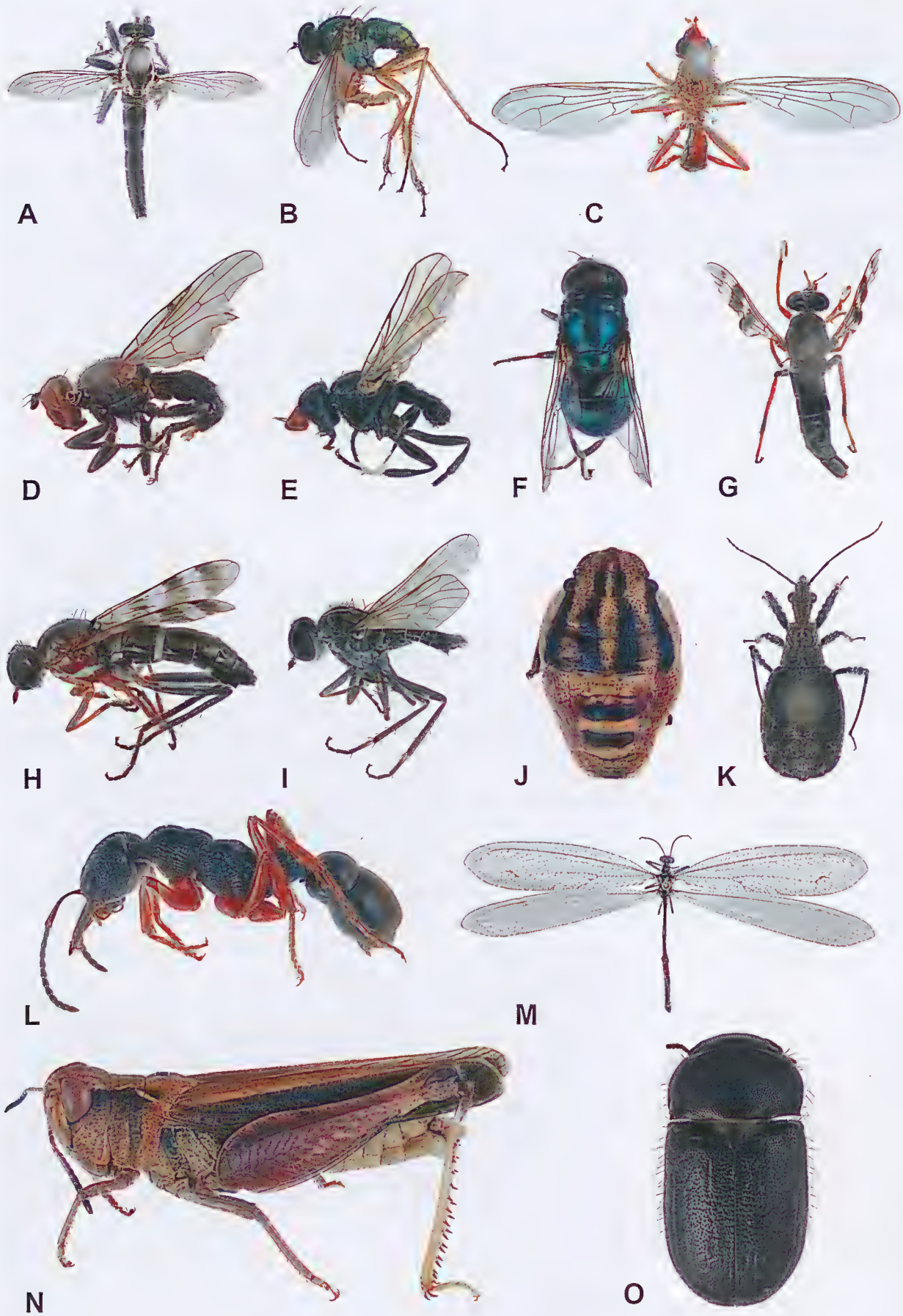
In total, 1088 taxa were recorded from the Spring Bay Mill property and adjacent coastal reserve (table 2). This comprises 144 vascular plants (Appendix 1.1); 23 mosses and 4 liverworts (Appendix 1.2); 124 lichens (Appendix 1.3); 689 terrestrial or freshwater aquatic invertebrates (683 insects, 3 spiders, 1 terrestrial isopod crustacean and 2 terrestrial gastropod molluscs) (Appendix 1.4); and 72 marine invertebrates (5 crustaceans, 12 bryozoans, 4 cnidarians, 4 tunicates and 47 marine molluscs) (Appendix 1.5). Additionally, 1 species of frog and 31 bird species were observed (Appendix 1.6).

The dominant habitats recorded were: grassy Black Sheoak *Allocasuarina littoralis* and Black Peppermint *Eucalyptus amygdalina* woodland with an understorey of Kangaroo Grass *Themeda triandra*, Wallaby Grasses *Rytidosperma* spp. and Sagg *Lomandra longifolia* (Glamping Glade fig. 1, table 1); White Gum *Eucalyptus viminalis* woodland over skeletal soils and sandstone rock plates (North West Corner fig. 1, table 1, pl. 1); and Drooping Sheoak *Allocasuarina verticillata* and Oyster Bay Pine *Callitris rhomboidea* woodland on sandstone clifftops (Cresponea Cliffs fig. 1, table 1, pls 2, 3). TASVEG classification units encountered, as described by Kitchener and Harris (2013), include *Allocasuarina verticillata* forest (NAV), *Eucalyptus amygdalina* forest and woodland on sandstone (DAS); *Allocasuarina littoralis* forest (NAL) and *Callitris rhomboidea* forest (NCR). Of note is that the latter three vegetation types equate to ones listed as threatened on Schedule 3A of the *Tasmanian Nature Conservation Act 2002*. Several taxa collected are new records for this area of the east coast of Tasmania, and provide infill of ranges for several common taxa of vascular plants such as Coast Speargrass *Austrostipa stipoides*, Pink Purslane *Calandrinia calyptrata*, Australian Saltgrass *Distichlis distichophylla*, Dense Woodrush *Luzula densiflora* and Streaked Arrowgrass *Triglochin striata*.

The bryophyte flora was restricted to a range of dry-country species growing on soil, with a few additional species on rocks or other substrates, and included taxa such as the liverwort *Chiloscyphus semiteres*, and mosses *Triquetrella papillata*, *Barbula calycina*, *Pseudocrossidium crinitum*, *Ceratodon purpureus* and *Campylopus introflexus*. The only exception to this trend was along a drainage line of a wastewater treatment system, where the bryophyte flora was dominated by taxa that grow in high-moisture locations, such as *Eurhynchium praelongum*. In general, bryophytes grew as scattered clumps or mats. However, the ground cover in a clearing in woodland just north of the beach at Windlass Bay consisted almost entirely of a large turf, several metres across, containing the same suite of species found in other dry parts of the property. No epiphytic taxa were recorded.

The lichen flora was dominated by saxicolous (rock-growing) species, either from the littoral zone or from the sandstone bluffs in dry sclerophyll woodland overlooking the sea. Epiphytes were largely absent, and many saxicolous taxa, such as the large foliose species of Parmeliaceae, showed obvious signs of physical damage. Three species collected during this survey are new to science: *Cresponea graemeannae* (pl. 4A) from the sandstone bluffs (Kantvilas 2020); *Dictyomeridium tasmanicum* from the bark of *A. verticillata* in coastal woodland (McCarthy & Kantvilas in press); and an undescribed species of *Cliostomum* from seashore rocks (pl. 4B). One species, *Buellia hypopurpurea*, represents a new record for Australia, and *Trapelia placodioides* a new record for Tasmania. In addition to the new taxa, three Tasmanian endemics were recorded: *Anisomeridium disjunctum*, *Lepra parathalassica* and *L. pseudodactylina*.

Surveys of insects at the Spring Bay Mill area recorded 683 taxa, with each of the main habitats present, including the foreshore, supporting characteristic species assemblages. Some of the more notable insects recorded are illustrated in plates 5 and 6. Many insect specimens could not be assigned to described species, due to a lack of available reference material. However, at least some of these are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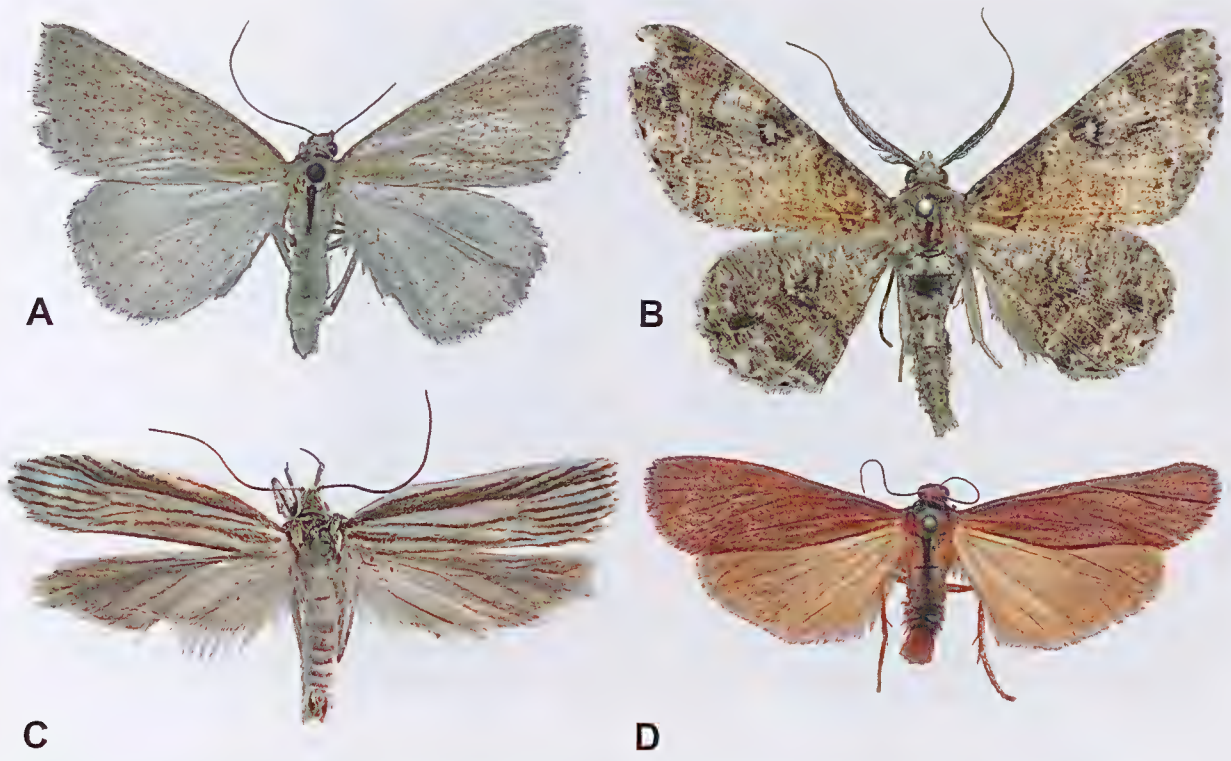

PLATE 6 – A selection of moths recorded from Spring Bay Mill. **A.** *Cassythaphaga petrochroa* (27 mm); **B.** *Cleora* sp. TMAG_F107069 (40 mm); **C.** *Xylorycta calligramma* (19 mm); **D.** *Scoliacma adrasta* (30 mm). Measurements = wingspan.

likely to represent species new to science. Table 3 lists insect taxa that are represented in the TMAG collections only by specimens from Spring Bay Mill and that are likely to be newly recorded undescribed taxa.

Several insect species were collected during this survey with few or no prior Tasmanian records. These included the casuarina-associated weevil *Misophrice hispida*, ripiphorid beetle *Sitarida scabriceps* (a parasitoid of wood-inhabiting beetles), oil-beetle Nemognathini unplaced sp. TMAG_F101079 (another parasitoid, perhaps of native bees), sandy-ground robberfly *Bathypogon nigrinus* (pl. 5A), wetland long-legged fly *Narabeenia spinipes* (pl. 5B), scarab-killing flies *Adapsilia* sp. TMAG_F101464 (pl. 5C) and *Cardiacera carnei* (pl. 5D), rhinophorid fly *Axinia* cf. *cornuta* (a parasitoid of slaters) (pl. 5E), dead-wood hoverfly *Psilota viridis* (pl. 5F), stiletto-flies *Acupalpa rostrata* (pl. 5G), *Acraspisa* sp. TMAG_F95917 (pl. 5H), *Parapsilocephala bifasciata* and *Parapsilocephala* sp. TMAG_F100830 (pl. 5I), grassland stink-bug *Eribotes leana* (pl. 5J), grassland assassin-bug *Coranus callosus* (pl. 5K), jackjumper-ant-relative *Myrmecia fulvipes* (pl. 5L), ant-lion *Mossega indecisa* (pl. 5M), and Golden Band-wing Grasshopper *Cryptobothrus chrysophorus* (pl. 5N).

Six undescribed moth species were recorded during this survey, all from the speciose micromoth genus *Elachista* in the gelechioid family Elachistidae (grass-miners) (table 3). Two new state records of moths (Appendix 1.4) are species from the large family Geometridae: *Cassythaphaga petrochroa* (pl. 6A), a member of the Gondwanan tribe Diptychini, collected in open coastal woodland at Freestone Point where its larvae feed on dodder laurels (*Cassytha*); and *Cleora* sp. TMAG_F107069 (pl. 6B), previously recorded from Victoria at Quiet Corner near remnant coastal vegetation. Finally, several moths that are either uncommon or poorly collected include *Xylorycta calligramma* (pl. 6C) (Xyloryctidae), the Tasmanian endemic footman moth *Scoliacma adrasta* (pl. 4D) (Erebidae), tiger moth *Paramsacta marginata* (Erebidae), an undescribed xyloryctine oecophorid, *Araestoma* ANIC sp. 01, and the geometrid *Taxeotis intermixtaria*.

PLATE 5 (opposite) – A selection of notable insects recorded from Spring Bay Mill. **A.** Robber-fly *Bathypogon nigrinus* (9 mm); **B.** Long-legged fly *Narabeenia spinipes* (4 mm); **C.** Scarab-killing fly *Adapsilia* sp. TMAG_F101464 (7 mm); **D.** Scarab-killing fly *Cardiacera carnei* (7 mm); (E) Rhinophorid fly *Axinia* cf *cornuta* (4 mm); **F.** Hoverfly *Psilota viridis* (7 mm); **G.** Stiletto-fly *Acupalpa rostrata* (7 mm); **H.** Stiletto-fly *Acraspisa* sp. TMAG_F95917 (5 mm); **I.** Stiletto-fly *Parapsilocephala* sp. TMAG_F100830 (4 mm); **J.** Stink-bug *Eribotes leana* (nymph) (3mm); **K.** Assassin-bug *Coranus callosus* (12 mm); **L.** Ant *Myrmecia fulvipes* (6 mm); **M.** Ant-lion *Mossega indecisa* (50 mm); **N.** Grasshopper *Cryptobothrus chrysophorus* (18 mm); **O.** Scarab beetle Melolonthinae unplaced sp. TMAG_F111109 (5 mm). Measurements = body length.

PLATE 7 – Colonisers of bare ground (flower inset). **A.** *Cynoglossum australe* (introduced), **B.** *Lysimachia arvensis* (introduced).

Threatened species

No plants or invertebrates listed under the Tasmanian *Threatened Species Protection Act 1995* were recorded from the property. Amongst the avifauna, the only such species observed (overhead) was the Wedge-tailed Eagle, which is listed as endangered but this species forages widely and no breeding habitat occurred in the survey area.

Exotic species

Thirty-nine species of introduced vascular plants were recorded (Appendix 1.1). Most are annual and perennial herbs and grass species of agricultural origin, confined mainly to disturbed areas of the property. A smaller number of taxa included environmental weeds of garden origin and were limited to single plants or small populations (Largeleaf Cotoneaster *Cotoneaster glaucophyllus* var. *serotinus*, Agapanthus *praecox* subsp. *orientalis*, New Zealand Cabbage Tree *Cordyline australis*, Yellow Pigface *Carpobrotus edulis*). Beach and foreshore vegetation supported discrete populations of Trailing Daisy *Dimorphotheca fruticosa* and Searocket *Cakile maritima*. Four species: Slender Thistle *Carduus pycnocephalus*, Winged Thistle *Carduus tenuiflorus*, Gorse *Ulex europaeus* and Spanish Heath *Erica lusitanica*, are declared weeds under the Tasmanian *Weed Management Act 1999*. One introduced species of moss *Eurhynchium praelongum* was also found on the property.

The Spring Bay Mill site also hosts a range of exotic invertebrate taxa (Appendix 1.4), including intentional and accidental introductions. The European Thistle Gall-fly *Urophora stylata* is an intentional introduction into Tasmania as a biocontrol agent of thistles; another, the weevil *Exapion ulicis*, was introduced into Tasmania from Europe to control Gorse; and two dung-beetle species *Aphodius fimetarius* and *Euoniticellus fulvus*, are also European introductions that are adept at processing the dung of introduced herbivores. The European slater *Porcellio scaber* was superabundant among strandline vegetation, to the extent that some of the pitfall traps set there were completely full of slaters after just a few days. A single specimen of the European plantain-associated weevil *Mecinus pascuorum*, was collected at Freestone Cove. In Australia, it is otherwise only known from the Hobart area where its presence was also only recently confirmed. Six marine invertebrate species are also introductions (Appendix 1.5) and consist of: a barnacle *Balanus trigonus*; two bivalve molluscs *Mytilus galloprovincialis* and *Magallana gigas*; two bryozoans (lace-corals) *Bugulina flabellata* and *Membranipora membranacea*; and an ascidian (sea-squirt) *Ascidiella aspersa*. Five species of bird (Appendix 1.6) are also introduced.

DISCUSSION

The Spring Bay Mill site supports remnant native, coastal vegetation within a general area where these communities have been under severe pressure from residential, agricultural and industrial development. It is also a fine example of a Triassic sandstone coastal environment, inviting comparison with other areas that share the same geology, such as Lime Bay, Midway Point, Adventure Bay and Randalls Bay. Amongst the lichens at least, there are recognised floristic similarities evident between these sites, as demonstrated by the presence of the uncommon, undescribed species of *Cliostomum*. Furthermore, these native vegetation remnants can be presumed to be secure from future development

and disturbance, as the current managers have declared a strong interest in conserving these bushland remnants and rehabilitating the property.

One of the stated aims of the TMAG Expedition program is to provide baseline biological data. In this respect, the Spring Bay Mill survey is particularly important as the owners embark on a plan to rehabilitate the natural values of the site. Already there are signs of significant regeneration of *Callitris*-dominated woodland (pl. 3), which over time may regain some of its associated epiphytes and insects.

The lichen flora of the site deserves special comment. Lichens are known to be remarkably ecologically sensitive organisms, and in other parts of the world have been used as indicators of pollution, environmental change or ecological integrity (Nimis *et al.* 2002). Despite the novelties discovered during this survey, the lichen flora of the site is neither unusual nor species-rich. Indeed, it tends to be unusually depauperate, with many habitats, especially tree bark in woodland communities, conspicuously devoid of epiphytes, including bryophytes. Furthermore, the signs of physical damage observed on many saxicolous lichens is suggestive of an ecological event or events that occurred during the site's industrial history.

In contrast, the insect fauna of the Spring Bay Mill proved to be remarkably rich despite being such a small site with a long industrial history, and significant discoveries (putative new species, novelties for Tasmania, range extensions or infills) were made. Overall the seasonal moth fauna of 195 species was typical of those found in spring in vegetation dominated by grasses with some stands of *Eucalyptus*, *Acacia* and *Allocasuarina*. This collection included around 15% of the known Lepidoptera in Tasmania, which equates to high species diversity for this area. Highest moth diversity was recorded at Freestone Point in coastal woodland, where 80 species were collected. This was also the location for one new state record and for three uncommon species. High moth diversity was also recorded in North West Corner and Quiet Corner, with about 60 species each. The abundance of leaf-litter dwellers from the micromoth family Oecophoridae contributed to the high species diversity in the North West Corner. The most common species by far was the pasture tunnel moth *Philobota productella* (Oecophoridae), which was attracted to light in extremely large numbers.

During its period of use as a woodchip mill, the property received trucks and logs from southern and eastern Tasmania, most likely leading to the introduction of species through contaminated loads and machinery. This, and its proximity to farmland, may account for the high numbers of introduced plants recorded at the property. Two species that readily colonise bare ground at the site are the introduced Scarlet Pimpernel *Lysimachia arvensis* and native Coast Houndstongue *Cynoglossum australe* (pl. 6). Both taxa are vigorous colonisers and were found to be widespread in areas of disturbance. The introduced succulent Yellow Pigface *Carpobrotus edulis* has become common to abundant and forms locally dense patches and could outcompete and/or hybridise with the native species *C. rossii,* as has been observed in South Australia (Biffin *et al.* 2016, Waycott 2016).

Appendix 1.3 lists several lichen novelties encountered during this survey. Of these, *Cresponea graemeannae* (pl. 4A) is an uncommon Tasmanian endemic that is now also known from South Sister to the north and Mt Forestier to the south (Kantvilas 2020). *Dictyomeridium tasmanicum* remains known only from the survey area (McCarthy & Kantvilas in press), and an undescribed species of *Cliostomum* (listed as '*Cliostomum* sp.' in Appendix 1.3) (pl. 4B) has since been found in other coastal sandstone areas in southeastern Tasmania.

Eleven insect taxa that are represented in TMAG collections exclusively by specimens collected from the Spring Bay Mill site are likely to be new or undescribed (table 3). Of these, the meloid beetle Nemognathini unplaced sp. TMAG_F101079, does not fit the descriptions of any in its tribe covered in the most recent review of the family in Australia (Bologna *et al.* 2013). The scarabaeid beetle Melolonthinae unplaced sp. TMAG_F111109 (pl. 5O), lacks some key characteristics that would usually enable identification to genus, so its taxonomic placement remains imprecise, but investigations are continuing. The scarab-killing (pyrgotid) fly *Adapsilia* sp. TMAG_F101464 (pl. 5C), does not fit the descriptions of any in its genus covered in the most recent Australian review of this unusual, nocturnal family (Paramonov 1958). The therevid fly *Parapsilocephala* sp. TMAG_F100830 (pl. 5I) collected from the grassland near Freestone Point belongs to a genus that has not been systematically reviewed and that undoubtedly contains more species than have been described. The velvet-ant (Mutillidae) *Ephutomorpha* sp. TMAG_F103101 (a winged male) was collected in the grassland near Freestone Point. It is among several from the TMAG collections currently on loan to researchers at ANIC where they may form the basis of new species descriptions. The six putative new species of *Elachista* moths were recorded from several sites. *Elachista* is a large genus with many undescribed species and includes members of the subfamily Elachistinae that comprises small moths whose caterpillars are leaf-miners. A recent comprehensive review of the Australian elachistine fauna enabled provisional identification of specimens as possibly new to science (Kaila 2011).

The mollusc shells found on the beaches represent assemblages typical for their shore types. The rocky sublittoral zone supported a wealth of encrusting invertebrates but was not thoroughly sampled. Despite this, the detection of six non-native species is probably indicative of the history of the site as a port, since ships and their ballast are postulated as having a long history of translocating marine species to Tasmanian waters (Sanderson 1990, Saunders & Withall 2006, Grove *et al.* 2018).

CONCLUSION

While the Spring Bay Mill property has endured a long period of use as an industrial site, and is still heavily degraded, it has retained patches of habitat containing high native species biodiversity which today are important refugia for species

lost from the wider landscape. These remnants provide a useful window into what the property may have looked like before its use as an industrial site for approximately 40 years, and provide an important guide to assist the owners with its future rehabilitation and conversion into a tourist accommodation and convention site.

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APPENDIX 1

Flora and fauna of the Spring Bay Mill property (taxa marked with + are new records for Tasmania and are followed by relevant specimen accession numbers; * were observed during the survey but not collected; - were recorded prior to the survey and during the survey; i are introduced taxa in Tasmania; ? are taxa that have an uncertain status, i.e., whether they are introduced or native at the site).

Appendix 1.1: Vascular Plant Taxa of Spring Bay Mill

EUDICOTS

Aizoaceae

i *Carpobrotus edulis* (L.) N.E.Br. subsp. *edulis*
Carpobrotus rossii (Haw.) Schwantes
Tetragonia implexicoma (Miq.) Hook.f.

Amaranthaceae

Einadia nutans (R.Br.) A.J.Scott subsp. *nutans*
Hemichroa pentandra R.Br.
Rhagodia candolleana Moq. subsp. *candolleana*
Sarcocornia quinqueflora (Bunge ex Ung.-Sternb.) A.J.Scott subsp. *tasmanica* Paul G.Wilson

Apiaceae

Apium prostratum Labill. ex Vent. subsp. *prostratum* var. *prostratum*

Asteraceae

i *Arctotis stoechadifolia* P.J.Bergius
Brachyscome aculeata (Labill.) Less.
i *Carduus pycnocephalus* L.
i *Carduus tenuiflorus* Curtis
Cassinia aculeata (Labill.) R.Br. subsp. *aculeata*
Conyza sumatrensis (Retz.) E.Walker
Coronidium scorpioides (Labill.) Paul G.Wilson
Cotula australis (Sieber ex Spreng.) Hook.f.
i *Dimorphotheca fruticosa* (L.) DC.
Euchiton japonicus (Thunb.) Holub
Gamochaeta calviceps (Fernald) Cabrera
i *Hypochaeris radicata* L.
Helichrysum luteoalbum (L.) Rchb.
Senecio glomeratus Desf. ex Poir. subsp. *glomeratus*
Senecio pinnatifolius A.Rich. var. *pinnatifolius*
Senecio quadridentatus Labill.
i *Sonchus asper* (L.) Hill
i *Sonchus oleraceus* L.
i *Tragopogon porrifolius* L. subsp. *porrifolius*
i *Vellereophyton dealbatum* (Thunb.) Hilliard & B.L.Burtt

Boraginaceae

- *Cynoglossum australe* R.Br.

Brassicaceae

i *Cakile maritima* Scop. subsp. *maritima*

Campanulaceae

Wahlenbergia gracilis (G.Forst.) A.DC.
Wahlenbergia gymnoclada Lothian
Wahlenbergia multicaulis Benth.

Caryophyllaceae

i *Cerastium vulgare* Hartm.
i *Silene gallica* L. var. *gallica*
Stellaria multiflora Hook. subsp. *multiflora*

Casuarinaceae

* *Allocasuarina verticillata* (Lam.) L.A.S.Johnson
Allocasuarina littoralis (Salisb.) L.A.S.Johnson

Celastraceae

Stackhousia monogyna Labill.

Convolvulaceae

Convolvulus angustissimus R.Br. subsp. *angustissimus*
Dichondra repens J.R.Forst. & G.Forst.

Crassulaceae

Crassula tetramera (Toelken) A.P.Druce & Sykes

Dilleniaceae

Hibbertia sericea (R.Br. ex DC.) Benth. var. *sericea*

Dipsacaceae

i *Dipsacus fullonum* L.

Ericaceae

i* *Erica lusitanica* Rudolphi
Leucopogon parviflorus (Andrews) Lindl.
Leucopogon virgatus (Labill.) R.Br. var. *virgatus*
Lissanthe strigosa (Sm.) R.Br. subsp. *subulata* (R.Br.) J.M.Powell

Fabaceae
Acacia dealbata Link subsp. dealbata
Acacia genistifolia Link
? *Acacia longifolia* (Andrews) Willd. subsp. *longifolia*
Acacia mearnsii De Wild.
Acacia melanoxylon R.Br.
Bossiaea cinerea R.Br.
i *Dipogon lignosus* (L.) Verdc.
Indigofera australis Willd. subsp. *australis*
Kennedia prostrata R.Br.
i *Medicago lupulina* L.
i *Ulex europaeus* L.
Gentianaceae
i *Centaurium erythraea* Rafn
Geraniaceae
Geranium solanderi Carolin
Goodeniaceae
Goodenia lanata R.Br.
Goodenia ovata Sm.
Haloragaceae
Gonocarpus tetragynus Labill.
Hypericaceae
Hypericum gramineum G.Forst.
Linaceae
Linum bienne Mill.
Malvaceae
Asterotrichion discolor (Hook.) Melville
Myrsinaceae
i *Lysimachia arvensis* (L.) U.Manns & Anderb.
Myrtaceae
Eucalyptus amygdalina Labill.
* *Eucalyptus globulus* Labill. subsp. *globulus*
Eucalyptus viminalis Labill. subsp. *viminalis*
? *Kunzea ambigua* (Sm.) Druce
Oxalidaceae
Oxalis radicosa A.Rich.
Papaveraceae
i *Papaver somniferum* L. subsp. *setigerum* (DC.) Arcang.
Plantaginaceae
i *Plantago coronopus* L. subsp. *coronopus*
i *Plantago lanceolata* L.
Portulacaceae
Calandrinia calyptrata Hook.f.
Proteaceae
Banksia marginata Cav.
Rhamnaceae
Pomaderris apetala Labill. subsp. *apetala*
Rosaceae
Acaena echinata Nees
Acaena novae-zelandiae Kirk
i* *Cotoneaster glaucophyllus* Franch. var. *serotinus* (Hutch.) L.T.Lu & Brach
Rutaceae
Boronia anemonifolia A.Cunn. subsp. *variabilis* (Hook.) P.G.Neish
Santalaceae
Exocarpos cupressiformis Labill.
Sapindaceae
Dodonaea viscosa Jacq. subsp. *spatulata* (Sm.) J.G.West
Scrophulariaceae
Myoporum insulare R.Br.
Solanaceae
Solanum vescum F.Muell.
Thymelaeaceae
Pimelea glauca R.Br.
Pimelea humilis R.Br.
Violaceae
Viola hederacea Labill. subsp. *hederacea*

GYMNOSPERMS
Cupressaceae
Callitris rhomboidea R.Br. ex Rich. & A.Rich.

MAGNOLIIDS
Lauraceae
Cassytha glabella R.Br. f. *glabella*

MONOCOTS
Agapanthaceae
i* *Agapanthus praecox* Willd. subsp. *orientalis* (F.M.Leight.) F.M.Leight.
Asparagaceae
Lomandra longifolia Labill.
Asphodelaceae
Bulbine glauca (Raf.) E.M.Watson
Centrolepidaceae
Centrolepis strigosa (R.Br.) Poir. subsp. *strigosa*
Cyperaceae
Carex breviculmis R.Br.
Carex fascicularis Sol. ex Boott
Ficinia nodosa (Rottb.) Goetgh., Muasya & D.A.Simpson
Gahnia filum (Labill.) F.Muell.
Gahnia radula (R.Br.) Benth.
Isolepis hookeriana Boeckeler
Lepidosperma concavum R.Br.
Lepidosperma curtisiae K.L.Wilson & D.I.Morris
Schoenus apogon Roem. & Schult.
Schoenus nitens (R.Br.) Poir.
Hemerocallidaceae
Dianella brevicaulis (Ostenf.) G.W.Carr & P.F.Horsfall
Dianella revoluta R.Br. var. *revoluta*
Dianella tasmanica Hook.f.
Juncaceae
Juncus kraussii Hochst. subsp. *australiensis* (Buchenau) Snogerup
Juncus pallidus R.Br.
Juncus planifolius R.Br.
Juncus subsecundus N.A.Wakef.
Luzula densiflora (H.Nordensk.) Edgar
Juncaginaceae
Triglochin striata Ruiz & Pav.
Laxmanniaceae
i* *Cordyline australis* (G.Forst.) Endl.

Orchidaceae
Diuris sulphurea R.Br.
Poaceae
i *Aira caryophyllea* L. subsp. *caryophyllea*
i *Anthoxanthum odoratum* L.
Austrostipa flavescens (Labill.) S.W.L.Jacobs & J.Everett
Austrostipa mollis (R.Br.) S.W.L.Jacobs & J.Everett
Austrostipa stipoides (Hook.f.) S.W.L.Jacobs & J.Everett
i *Avena sativa* L.
i *Briza minor* L.
i *Bromus catharticus* Vahl
i *Bromus cebadilla* Steud.
i *Bromus hordeaceus* L.
i *Cynosurus echinatus* L.
i *Dactylis glomerata* L.
Distichlis distichophylla (Labill.) Fassett
i *Festuca arundinacea* Schreb.
i *Holcus lanatus* L.
Lachnagrostis filiformis (G.Forst.) Trin.
i *Lolium perenne* L.
Poa poiformis (Labill.) Druce var. *poiformis*
Poa rodwayi Vickery
Rytidosperma caespitosum (Gaudich.) Connor & Edgar
Rytidosperma racemosum (R.Br.) Connor & Edgar var. *racemosum*
Rytidosperma setaceum (R.Br.) Connor & Edgar
Themeda triandra Forssk.
i *Vulpia bromoides* (L.) Gray
Restionaceae
Hypolaena fastigiata R.Br.

PTERIDOPHYTES
Dennstaedtiaceae
Hypolepis rugosula (Labill.) J.Sm.
Pteridium esculentum (G.Forst.) Cockayne subsp. *esculentum*

Appendix 1.2: Bryophyte Taxa of Spring Bay Mill

MOSSES
Brachytheciaceae
i *Eurhynchium praelongum* (Hedw.) Bruch & Schimp.
Rhynchostegium tenuifolium (Hedw.) Reichardt
Bryaceae
Bryum sp.
Bryum crassum Hook.f. & Wilson
Bryum dichotomum Hedw.
Rosulabryum campylothecium (Taylor) J.R.Spence
Rosulabryum capillare (Hedw.) J.R.Spence
Rosulabryum subtomentosum (Hampe) J.R.Spence
Rosulabryum torquescens (Bruch & Schimp.) J.R.Spence
Dicranaceae
Campylopus appressifolius Mitt.
Campylopus introflexus (Hedw.) Brid.
Ceratodon purpureus (Hedw.) Brid.
Grimmiaceae
Grimmia pulvinata (Hedw.) Sm.
Hypnaceae
Hypnum cupressiforme Hedw.
Lembophyllaceae
Lembophyllum divulsum (Hook.f. & Wilson) Lindb.
Polytrichaceae
Polytrichum juniperinum Hedw.
Pottiaceae
Barbula calycina Schwägr.
Pseudocrossidium sp.
Pseudocrossidium crinitum (Schultz) R.H.Zander
Triquetrella papillata (Hook.f. & Wilson) Broth.
Ptychomitriaceae
Ptychomitrium mittenii A.Jaeger
Ptychomnion aciculare (Brid.) Mitt.
Racopilaceae
Racopilum cuspidigerum (Schwägr.) Ångstr. var. *convolutaceum* (Müll.Hal.) Zanten & Dijkstra

LIVERWORTS
Frullaniaceae
Frullania probosciphora Taylor
Geocalycaceae
Chiloscyphus semiteres (Lehm.) Lehm. & Lindenb.
Chiloscyphus subporosus (Mitt.) J.J.Engel & R.M.Schust. var. *subporosus*
Marchantiaceae
Lunularia cruciata (L.) Dumort.

Appendix 1.3: Lichen Taxa of Spring Bay Mill

Acarospora fuscata (Nyl.) Arnold
Acarospora veronensis A.Massal.
Amandinea brunneola Elix & H.Mayrhofer
Amandinea coniops (Wahlenb.) M.Choisy ex Scheid. & H.Mayrhofer
Amandinea decedens (Nyl.) Blaha & H.Mayrhofer
Amandinea destituta Elix & Kantvilas
Amandinea litoralis (Zahlbr.) H.Mayrhofer & Elix
Amandinea neoconglomerata Elix
Amandinea prothallinata Elix & H.Mayrhofer
Anisomeridium disjunctum P.M.McCarthy & Kantvilas
Austroparmelina labrosa (Zahlbr.) A.Crespo, Divakar & Elix
Austroparmelina conlabrosa (Hale) A.Crespo, Divakar & Elix
Buellia dissa (Stirt.) Zahlbr.
Buellia extenuatella Elix & Kantvilas
Buellia cranwelliae Zahlbr.
Buellia fertilis Körb.
Buellia halonia (Ach.) Tuck.
Buellia halonioides Elix
Buellia homophylia (C.Knight) Zahlbr.
+ *Buellia hypopurpurea* Elix & A.Knight (HO599045)
Buellia kantvilasii Elix, Blanchon & A.Knight
Buellia stellulata (Taylor) Mudd var. *stellulata*

Buellia suttonensis Elix & A.Knight
Caloplaca bermaguiana S.Y.Kondr. & Kärnefelt
Caloplaca cribrosa (Hue) Zahlbr.
Caloplaca eos S.Y.Kondr. & Kärnefelt
Caloplaca gallowayi S.Y.Kondr., Kärnefelt & Filson
Caloplaca holocarpa (Hoffm.) A.E.Wade
Caloplaca kilcundaensis S.Y.Kondr. & Kärnefelt
Caloplaca maccarthyi S.Y.Kondr., Kärnefelt & Elix
Caloplaca rexfilsonii S.Y.Kondr. & Kärnefelt
Caloplaca sublobulata (Nyl.) Zahlbr.
Candelariella aurella (Hoffm.) Zahlbr.
Candelariella vitellina (Hoffm.) Müll.Arg.
Candelariella xanthostigmoides (Müll.Arg.) R.W.Rogers
Carbonea latypizodes (Müll.Arg.) Knoph & Rambold
Catillaria sp.
Cladia aggregata (Sw.) Nyl.
Cladia schizopora (Nyl.) Nyl.
Cladonia enantia Nyl. var. *enantia*
Cladonia ramulosa (With.) J.R.Laundon
Cladonia rigida (Hook.f. & Taylor) Hampe var. *rigida*
Cladonia verticillata (Hoffm.) Schaer.
Cladonia subradiata (Vain.) Sandst.
Cliostomum griffithii (Hoffm.) Schaer.
+ *Cliostomum* sp. (HO602358)
Cresponea graemeannae Kantvilas
+ *Dictyomeridium tasmanicum* P.M. MCarthy & Kantvilas ined. (HO602363)
Diploicia canescens (Dicks.) A.Massal.
Diploschistes gyrophoricus Lumbsch & Elix
Enterographa divergens (Müll.Arg.) Redinger
Flavoparmelia haysomii (C.W.Dodge) Hale
Flavoparmelia rutidota (Hook.f. & Taylor) Hale
Halegrapha mucronata (Stirt.) Lücking
Hypocenomyce australis Timdal
Hypocenomyce scalaris (Ach.) M.Choisy
Hypotrachyna revoluta (Flörke) Hale
Lecanora dispersa (Pers.) Sommerf.
Lecanora farinacea Fée
Lecanora flavopallida Stirt.
Lecanora galactiniza Nyl.
Lecanora margarodes (Körb.) Nyl.
Lecanora pseudistera Nyl.
Lecanora pseudogangaleoides Lumbsch subsp. *pseudogangaleoides*
Lecanora aff. *planaica* Lumbsch
Lecidea sarcogynoides Körb.
Lecidella granulosula (Nyl.) Knoph & Leuckert var. *granulosula*
Lecidella stigmatea (Ach.) Hertel & Leuckert
Lepra parathalassica (Kantvilas & Elix) A.W.Archer & Elix
Lepra pseudodactylina (A.W.Archer) A.W.Archer & Elix
Lepraria finkii (de Lesd.) R.C.Harris
Lichina intermedia (C.Bab.) M.Schultz
Menegazzia subpertusa P.James & D.J.Galloway
Micarea almbornii Coppins
Micarea denigrata (Fr.) Hedl.
Mycoblastus sp.
Ochrolechia apiculata Verseghy
Opegrapha atra Pers.
Opegrapha varia Pers.
Opegrapha sp. A
Pannaria elixii P.M.Jørg. & D.J.Galloway
Paraporpidia leptocarpa (C.Bab. & Mitt.) Rambold & Hertel
Parmotrema cetratum (Ach.) Hale
Pertusaria crassilabra Müll.Arg.
Pertusaria lophocarpa Körb.
Pertusaria trimera (Müll.Arg.) A.W.Archer
Physcia poncinsii Hue
Porina corrugata Müll.Arg.
Porina leptalea (Durieu & Mont.) A.L.Sm.
Porina whinrayi P.M.McCarthy
Porpidia sp.
Pseudocyphellaria crocata (L.) Vain.
Punctelia pseudocoralloidea (Gyeln.) Elix & Kantvilas
Ramalina canariensis J.Steiner
Ramalina fissa (Müll.Arg.) Vain.
Ramboldia stuartii (Hampe) Kantvilas & Elix
Rhizocarpon reductum Th.Fr.
Rinodina australiensis Müll.Arg
Rinodina blastidiata Matzer & H.Mayrhofer
Rinodina murrayi H.Mayrhofer
Rinodina oleae Bagl.
Rinodina oxydata (A.Massal.) A.Massal.
Rinodina teniswoodiorum Elix & Kantvilas
Sarcogyne regularis Körb.
Teloschistes spinosus (Hook.f. & Taylor) J.S.Murray
Tephromela alectoronica Kalb
Tephromela atra (Huds.) Hafellner
Tephromela campestricola (Nyl.) Rambold & Triebel
Thelenella tasmanica H.Mayrhofer & P.M.McCarthy
Thysanothecium scutellatum (Fr.) D.J.Galloway
Trapelia glebulosa (Sm.) J.R.Laundon
+ *Trapelia placodioides* Coppins & P.James (HO602353)
Tylothallia verrucosa (Müll.Arg.) Kantvilas
Usnea cornuta Körb.
Verrucaria fusconigrescens Nyl.
Verrucaria maura Wahlenb.
Verrucaria subdiscreta P.M.McCarthy
Xanthoparmelia australasica D.J.Galloway
Xanthoparmelia canobolasensis Elix
Xanthoparmelia mougeotina (Nyl.) D.J.Galloway
Xanthoparmelia subprolixa (Nyl. ex Kremp.) O.Blanco, A.Crespo, Elix, D.Hawksw. & Lumbsch
Xanthoparmelia verrucella (Essl.) O.Blanco, A.Crespo, Elix, D.Hawksw. & Lumbsch
Xanthoria sp.
Xanthoria ligulata (Körb.) P.James

Appendix 1.4: Terrestrial or freshwater invertebrate taxa of Spring Bay Mill

INSECTA

BLATTODEA (COCKROACHES AND TERMITES)

Blaberidae

Calolampra sp. TMAG_F12724

Blattidae

Platyzosteria biglumis (Saussure, 1864)

Termitoidae

Termitoidae unplaced sp. TMAG_F103022

Termitoidae unplaced sp. TMAG_F103024

COLEOPTERA (BEETLES)

Aderidae

Aderidae unplaced sp. TMAG_F101185

Aderidae unplaced sp. TMAG_F102257

Anthicidae

Anthicidae unplaced sp. TMAG_F102256

Anthicidae unplaced sp. TMAG_F103189

Anthicidae unplaced sp. TMAG_F95636

Omonadus hesperi (King, 1869)

Pseudocyclodinus strictus (Erichson, 1842)

Tomoderus sp. TMAG_F102310

Trichananca victoriensis Blackburn, 1891

Anthribidae

Euciodes suturalis Pascoe, 1866

Bolboceratidae

Elephastomus proboscideus (Schreibers, 1802)

Bostrichidae

Xylion collaris (Erichson, 1842)

Xylobosca canina (Blackburn, 1893)

Brentidae

i *Exapion ulicis* (Forster, 1770)

Buprestidae

Agrilus assimilis australis Thomson, 1879

Diphucrania acuducta (Kirby, 1837)

Germarica lilliputana (Thomson, 1879)

Melobasis micontola LEVY MS NAME

Cantharidae

Chauliognathus lugubris (Fabricius, 1801)

Chauliognathus tricolor (Castelnau, 1840)

Heteromastix pauxillus (Blackburn, 1888)

Carabidae

Amblytelus brevis Blackburn, 1892

Anomotarus crudelis (Newman, 1840)

Anomotarus illawarrae (Macleay, 1873)

Carabidae unplaced sp. TMAG_F95840

Hypharpax peronii (Castelnau, 1867)

Mecyclothorax ambiguus (Erichson, 1842)

Notagonum marginellum (Erichson, 1842)

Pseudoceneus sollicitus (Erichson, 1842)

Sarothrocrepis integra Baehr, 2018

Trigonothops pacifica (Erichson, 1842)

Cerambycidae

Ancita crocogaster (Boisduval, 1835)

Ancita marginicollis (Boisduval, 1835)

Atesta tasmanica (Gahan, 1893)

Bethelium diversicorne (White, 1846)

Callidiopini unplaced sp. TMAG_F100860

Callidiopini unplaced sp. TMAG_F33390

Callidiopis scutellaris (Fabricius, 1801)

Ectosticta cleroides (White, 1855)

Epithora dorsalis (W.S. Macleay, 1826)

Neissa inconspicua Pascoe, 1866

Omophaena taeniata Pascoe, 1866

Phacodes obscurus (Fabricius, 1787)

Phacodes personatus Erichson, 1842

Phoracantha synonyma Newman, 1840

Stenoderus suturalis (Olivier, 1795)

Chrysomelidae

Alticini unplaced sp. TMAG_F57337

Arsipoda sp. TMAG_F104713

Arsipoda sp. TMAG_F98512

Ditropidus ochropus Erichson, 1842

Ditropidus subaeneus Chapuis, 1875

Eurispa albipennis (Germar, 1848)

Monolepta unplaced

Paropsisterna bimaculata (Olivier, 1807)

Paropsisterna decolorata (Chapuis, 1877)

Paropsisterna simsoni (Blackburn, 1899)

Peltoschema DE LITTLE sp. 03

Cleridae

Eleale aspera Newman, 1841

Eleale simplex (Newman, 1840)

Eunatalis porcata (Fabricius, 1787)

Lemidia bella (Westwood, 1853)

Lemidia cicatricosa Lea, 1907

Lemidia subaenea Gorham, 1877

Parapylus bicinctus (Newman, 1842)

Pylus fatuus (Newman, 1841)

Tarsostenus hilaris (Westwood, 1849)

Tenerus abbreviatus White, 1849

Coccinellidae

Bucolellus minutus (Blackburn, 1892)

Cleobora mellyi (Mulsant, 1850)

Coccinella transversalis Fabricius, 1781

i *Coccinella undecimpunctata* Linnaeus, 1758

Diomus notescens (Blackburn, 1889)

Diomus pumilio Weise, 1885

i *Hippodamia variegata* (Goeze, 1777)

Orcus bilunulatus (Boisduval, 1835)

Rhyzobius TFIC sp. 07

Rhyzobius TFIC sp. 15

Rhyzobius TFIC sp. 35

Stethorus sp. TMAG_F102393

Corylophidae

Corylophidae unplaced sp. TMAG_F104902

Curculionidae

Ambrosiodmus compressus (Lea, 1894)

Amycterus cf *tenebricosus* (Ferguson, 1912)

Ancyttalia TFIC sp. 01

Aoplocnemis sp. TMAG_F101856

Aoplocnemis TFIC sp. 03

Cossoninae unplaced sp. TMAG_F101180

Curculionidae unplaced sp. TMAG_F101270

Curculionidae unplaced sp. TMAG_F95604

Epamoebus ziczac Lea, 1909

Eugnomini unplaced sp. TMAG_F101234
Exithius sp. TMAG_F101726
Haplonyx casuarinae (Lea, 1909)
Mandalotus sp. TMAG_F101178
Mandalotus sp. TMAG_F101319
Mandalotus sp. TMAG_F101554
i *Mecinus pascuorum* (Gyllenhal, 1813)
Melanterius costipennis Lea, 1905
Melanterius TFIC sp. 01
Merimnetes oblongus (Blanchard, 1853)
Misophrice gloriosa Lea, 1906
Misophrice hispida Pascoe, 1872
Misophrice parallela Blackburn, 1890
Misophrice variabilis Blackburn, 1890
Mythites tuberculatus Schoenherr, 1847
Neolaemosaccus narinus (Pascoe, 1872)
Neolaemosaccus sp. TMAG_F100880
Orthorhinus cylindrirostris (Fabricius, 1775)
Orthorhinus klugii Boheman, 1835
Pelororhinus TFIC sp. 01
i *Phlyctinus callosus* (Schoenherr, 1826)
Prostomus scutellaris (Fabricius, 1787)
Pseudotimareta subterranea (Lea, 1908)
Storeus albosignatus (Blackburn, 1890)
Xyleborus saxeseni (Ratzeburg, 1837)

Dermestidae
i *Attagenus pellio* (Linnaeus, 1758)
Trogoderma sp. TMAG_F100945
Trogoderma sp. TMAG_F102318

Elateridae
Agrypnus impressicollis (Elston, 1924)
Agrypnus TFIC sp. 04
Agrypnus victoriae (Candèze, 1865)
Conoderus basalis (Gyllenhal, 1817)
Conoderus erubescens (Candèze, 1859)
Conoderus fabrilis (Erichson, 1842)
Conoderus TFIC sp. 05
Conoderus TFIC sp. 06
Elateridae unplaced TFIC sp. 10

Erotylidae
Thallis compta Erichson, 1842
Thallis vinula Erichson, 1842

Eucnemidae
Eucnemidae unplaced sp. TMAG_F102313
Myall clavicornis (Lea, 1919)

Histeridae
Teretrius sorellensis Blackburn, 1903

Hydrophilidae
Enochrus sp. TMAG_F101078
Ercycodes tasmanicus Hansen, 1990
Helochares tristis (W.J. Macleay, 1871)
Paracymus pygmaeus (W.J. Macleay, 1871)

Latridiidae
Cartodere satelles (Blackburn, 1888)
Cortinicara TFIC sp. 02
Enicmus REIKE sp. nov 1

Meloidae
+ Nemognathini unplaced sp. TMAG_F101079

Melyridae
Carphurus punctatus Lea, 1909
Dasytes granulipennis Lea, 1909
Hypattalus exilis Lea, 1909
Melyridae unplaced sp. TMAG_F101271

Mordellidae
Glipostenoda TFIC sp. 09
Mordella TFIC sp. 01
Mordellidae unplaced TFIC sp. 01
Mordellidae unplaced TFIC sp. 04

Nitidulidae
Brachypeplus binotatus Murray, 1864
Epuraea meyricki (Blackburn, 1891)
Thalycrodes australis (Germar, 1848)
Thalycrodes pulchrum Blackburn, 1891

Oedemeridae
Oedemeridae unplaced sp. TMAG_F44510
Sessinia punctum (W.S. Macleay, 1826)

Phalacridae
Litochrus TFIC sp. 01
Phalacridae unplaced sp. TMAG_F115676
Phalacrus uniformis (Blackburn, 1891)

Ptiliidae
Acrotrichis TFIC sp. 01

Ptinidae
Deltocryptus sp. TMAG_F47346
Deltocryptus sp. TMAG_F98780
Deltocryptus TFIC sp. 01
Deltocryptus TFIC sp. 04
Dryophilodes TFIC sp. 07
Hadrobregmus australiensis Pic, 1901
Priobium multimaculatus Lea, 1924
Ptinidae unplaced sp. TMAG_F97269
Ptinus exulans Erichson, 1842

Ripiphoridae
Sitarida scabriceps Lea, 1914

Salpingidae
Neosalpingus hybridus (Erichson, 1842)

Scarabaeidae
i *Aphodius fimetarius* (Linnaeus, 1758)
Diphucephala colaspidoides (Gyllenhal, 1817)
i *Euoniticellus fulvus* (Goeze, 1777)
Heteronyx aphodioides Blanchard, 1850
Heteronyx cervina (Boisduval, 1835)
Heteronyx comans Blackburn, 1909
Heteronyx excisus Blackburn, 1890
Heteronyx oblongus Blanchard, 1850
+ Melolonthinae unplaced sp. TMAG_F111109
Onthophagus auritus Erichson, 1842
Onthophagus australis Guérin-Méneville, 1838
Onthophagus pronus Erichson, 1842
Phyllotocus macleayi Fischer, 1823
Phyllotocus rufipennis (Boisduval, 1835)
Scitala sericans Erichson, 1842
Telura alta Britton, 1987

Scirtidae
Spilotocyphon spilotus (Blackburn, 1892)

Scraptiidae
Scraptia sp. TMAG_F100884

Silphidae
Ptomaphila lacrymosa (Schreibers, 1802)
Staphylinidae
Aleocharinae unplaced
Blediotrogus sp. TMAG_F41848
Cafius catenatus Fauvel, 1877
i *Carpelimus exiguus* (Erichson, 1839)
Creophilus erythrocephalus (Fabricius, 1775)
Horaeomorphus TFIC sp. 03
Paederus cruenticollis Germar, 1848
Pselaphinae unplaced sp. TMAG_F102263
Quediomimus hybridus (Erichson, 1840)
Quediomimus sp. TMAG_F100876
Quedius sp. TMAG_F98639
Quedius TFIC sp. 04
Sepedophilus sp. TMAG_F103193
Staphylininae unplaced sp. TMAG_F100878
Staphylininae unplaced sp. TMAG_F96390
Tenebrionidae
Adelium brevicorne Blessig, 1861
Adelium tenebroides Erichson, 1842
Isopteron aversum (Pascoe, 1869)
Nocar depressiusculus (Macleay, 1872)
Pachycoelia sulcicollis Boisduval, 1835
Saragus costatus (Solier, 1848)
Titaena columbina Erichson, 1842
Throscidae
Aulonothroscus elongatus (Bonvouloir, 1859)
Throscidae unplaced sp. TMAG_F98854
Trogidae
Omorgus australasiae (Erichson, 1842)
Trogossitidae
Leperina decorata (Erichson, 1842)

DERMAPTERA (EARWIGS)
Labiduridae
Labidura riparia (Pallas, 1773)

DIPTERA (FLIES)
Acroceridae
Ogcodes flavescens White, 1914
Agromyzidae
Agromyzidae unplaced sp. TMAG_F101002
Anthomyiidae
Fucellia tergina (Zetterstedt, 1845)
Asilidae
Bathypogon nigrinus Ricardo, 1912
Cerdistus caliginosus (White, 1914)
Cerdistus flavicinctus (White, 1914)
Cerdistus hyalipennis Ricardo, 1913
Cerdistus sp. TMAG_F104823
Cerdistus vittipes (Macquart, 1847)
Leptogaster sp. TMAG_F97213
Zosteria alcetas (Walker, 1849)
Australimyzidae
Australimyza mcalpinei Brake & Mathis, 2007
Bibionidae
Dilophus unplaced
Bombyliidae
Docidomyia puellaris White, 1916
Exechohypopion nigricostatum (Macquart, 1850)
Exechohypopion sp. TMAG_F46884
Geron sp. TMAG_F96709
Villa fuscicostata (Macquart, 1846)
Calliphoridae
Calliphora hilli Patton, 1925
Calliphora sp. TMAG_F101873
Calliphora stygia (Fabricius, 1782)
Onesia sp. TMAG_F98547
Chaoboridae
Chaoboridae unplaced sp. TMAG_F101045
Chaoboridae unplaced sp. TMAG_F101343
Chloropidae
Chloropidae unplaced sp. TMAG_F101356
Chloropidae unplaced sp. TMAG_F101429
Chloropidae unplaced sp. TMAG_F98226
Chloropidae unplaced sp. TMAG_F98232
Coelopidae
Amma blancheae McAlpine, 1991
Chaetocoelopa sydneyensis (Schiner, 1868)
Gluma nitida McAlpine, 1991
Rhis whitleyi McAlpine, 1991
Dolichopodidae
Dolichopodidae unplaced sp. TMAG_F100541
Dolichopodidae unplaced sp. TMAG_F100593
Dolichopodidae unplaced sp. TMAG_F102357
Heteropsilopus cingulipes (Walker, 1835)
Narabeenia spinipes Bickel, 1994
Sciapodinae unplaced sp. TMAG_F103147
Sciapodinae unplaced sp. TMAG_F97454
Empididae
Empididae unplaced sp. TMAG_F41360
Ephydridae
Ephydrella unplaced
Ephydridae unplaced sp. TMAG_F101059
Ephydridae unplaced sp. TMAG_F101884
Hydrellia tritici Coquillett, 1903
Scatella albilutea Mathis & Wirth, 1981
Heteromyzidae
Diplogeomyza cf *conformis* McAlpine, 1967
Hybotidae
Hybotidae unplaced sp. TMAG_F101880
Hybotidae unplaced sp. TMAG_F98298
Keroplatidae
Keroplatidae unplaced sp. TMAG_F104834
Lauxaniidae
Homoneura sp. TMAG_F100519
Homoneura sp. TMAG_F101118
Incurviseta sp. TMAG_F101050
Lauxaniidae unplaced sp. TMAG_F101421
Poecilohetaerus aquilus Schneider, 1991
Poecilohetaerus schineri Hendel, 1907
Sapromyza metallica Walker, 1853
Limoniidae
Gynoplistia bella (Walker, 1835)
Limoniidae unplaced sp. TMAG_F100949
Limoniidae unplaced sp. TMAG_F101129

Lonchaeidae
Lonchaeidae unplaced sp. TMAG_F6351
Lonchopteridae
i *Lonchoptera bifurcata* Fallén, 1810
Muscidae
Coenosia sp. TMAG_F101349
Coenosia sp. TMAG_F101530
Coenosia sp. TMAG_F47332
Helina sp. TMAG_F100528
Helina sp. TMAG_F101117
Helina sp. TMAG_F12791
Muscidae unplaced sp. TMAG_F100842
Muscidae unplaced sp. TMAG_F101088
Muscidae unplaced sp. TMAG_F101111
Muscidae unplaced sp. TMAG_F101209
Muscidae unplaced sp. TMAG_F47357
Muscidae unplaced sp. TMAG_F47360
Muscidae unplaced sp. TMAG_F57515
Muscidae unplaced sp. TMAG_F97355
Pygophora apicalis Schiner, 1868
Mycetophilidae
Mycetophilidae unplaced sp. TMAG_F101881
Paraleucopidae
Paraleucopidae unplaced sp. TMAG_F103034
Phoridae
Phoridae unplaced sp. TMAG_F104830
Platystomatidae
Rivellia unplaced
Pyrgotidae
+ *Adapsilia* sp. TMAG_F101464
Cardiacera carnei (Paramonov, 1958)
Rhiniidae
Stomorhina subapicalis (Macquart, 1847)
Rhinophoridae
Axinia cf *cornuta* Colless, 1994
Sarcophagidae
Oxysarcodexia varia (Walker, 1836)
Protomiltogramma laticeps Malloch, 1930
Sarcophaginae unplaced sp. TMAG_F100970
Sciomyzidae
Dichetophora australis (Walker, 1853)
Pherbellia juxtajavana Knutson, Manguin & Orth, 1990
Sphaeroceridae
Thoracochaeta unplaced
Stratiomyidae
Damaromyia sp. TMAG_F102147
Odontomyia sp. TMAG_F96259
Pachygastrinae unplaced sp. TMAG_F104917
Syrphidae
Eumerus argyrogaster Ferguson, 1926
Melangyna viridiceps (Macquart, 1847)
Psilota viridis Macquart, 1847
Simosyrphus grandicornis (Macquart, 1842)
Tabanidae
Dasybasis sp. TMAG_F46925
Tachinidae
Amphibolia vidua (Guérin-Méneville, 1843)
Cylindromyia sp. TMAG_F101531
Tachinidae unplaced sp. TMAG_F100840
Tachinidae unplaced sp. TMAG_F101872
Tachinidae unplaced sp. TMAG_F102332
Tachinidae unplaced sp. TMAG_F102436
Tachinidae unplaced sp. TMAG_F103153
Tachinidae unplaced sp. TMAG_F47646
Tachinidae unplaced sp. TMAG_F95526
Tachinidae unplaced sp. TMAG_F96034
Tephritidae
Austrotephritis bushi (Hardy & Drew, 1996)
Sphenella ruficeps (Macquart, 1851)
Tephritidae unplaced sp. TMAG_F100966
i *Urophora stylata* (Fabricius, 1775)
Therevidae
Acraspisa sp. TMAG_F95917
Acupalpa rostrata Kröber, 1912
Agapophytus quatiens (White, 1916)
Anabarhynchus latifrons (Macquart, 1848)
Ectinorhynchus unplaced
Evansomyia phyciformis (White, 1916)
Neodialineura nitens (White, 1916)
Parapsilocephala bifasciata White, 1916
+ *Parapsilocephala* sp. TMAG_F100830
Tipulidae
Tipulidae unplaced sp. TMAG_F47023

HEMIPTERA (BUGS)
Acanthosomatidae
Acanthosomatidae unplaced sp. TMAG_F57818
Achilidae
Argeleusa sp. TMAG_F57755
Alydidae
Mutusca brevicornis (Dallas, 1852)
Aphididae
Cinara unplaced
Aradidae
Calisius tasmanicus Kormilev, 1963
Cercopidae
Philagra parva (Donovan, 1805)
Cicadellidae
Brunotartessus fulvus (Walker, 1851)
Cicadellidae unplaced sp. TMAG_F104906
Deltocephalinae unplaced sp. TMAG_F101521
Deltocephalinae unplaced sp. TMAG_F101629
Eurymeloides punctata (Signoret, 1850)
Putoniessa nigrella Evans, 1966
Tartessinae unplaced sp. TMAG_F47837
Tartessinae unplaced sp. TMAG_F57750
Clastopteridae
Chaetophyes compacta (Walker, 1851)
Coreidae
Agriopocoris unplaced
Corixidae
Diaprepocoris barycephala Kirkaldy, 1897
Sigara neboissi Lansbury, 1970
Cryptorhamphidae
Cryptorhamphus orbus Stål, 1860
Cydnidae
Adrisa sp. TMAG_F98735

Macroscytus sp. TMAG_F101568
Macroscytus sp. TMAG_F6477
Delphacidae
Delphacidae unplaced sp. TMAG_F100926
Flatidae
Anzora unicolor (Walker, 1862)
Siphanta cf *hebes* (Walker, 1851)
Hydrometridae
Hydrometra strigosa (Skuse, 1893)
Lygaeidae
Nysius sp. TMAG_F100513
Membracidae
Ceraon tasmaniae (Fairmaire, 1846)
Micronectidae
Micronecta robusta Hale, 1922
Miridae
Ausejanus sp. TMAG_F104910
Miridae unplaced sp. TMAG_F101434
Miridae unplaced sp. TMAG_F57789
Miridae unplaced sp. TMAG_F59004
Ommatodema leanum Poppius, 1911
Pseudopantilius australis (Walker, 1873)
Nabidae
Nabis kinbergii Reuter, 1872
Ochteridae
Ochterus unplaced
Pentatomidae
Agonoscelis rutila (Fabricius, 1775)
Anaxilaus vesiculosus (Herrich-Schäffer, 1840)
Diaphyta rosea Bergroth, 1912
Dictyotus caenosus (Westwood, 1837)
Eribotes leana Distant, 1910
Pentatomidae unplaced sp. TMAG_F57779
Pentatomidae unplaced sp. TMAG_F96675
Psyllidae
Acizzia sp. TMAG_F100925
Psyllidae unplaced sp. TMAG_F100766
Psyllidae unplaced sp. TMAG_F103016
Psyllidae unplaced sp. TMAG_F103116
Reduviidae
Coranus callosus Stål, 1874
Gminatus australis (Erichson, 1842)
Nyllius asperatus Stål, 1859
Peirates fuliginosus (Erichson, 1842)
Ptilocnemus femoralis Horváth, 1902
Rhyparochromidae
Brentiscerus putoni (White, 1878)
Dieuches notatus (Dallas, 1852)
Rhyparochromidae unplaced sp. TMAG_F57782
Rhyparochromidae unplaced sp. TMAG_F96950
Ricaniidae
Aprivesa sp. TMAG_F104753
Saldidae
Saldula unplaced
Scutelleridae
Choerocoris paganus (Fabricius, 1775)
Tingidae
Epimixia allocasuarina Cassis, Symonds & Branson, 2019

HYMENOPTERA (ANTS, BEES AND WASPS)
Apidae
i *Apis mellifera* Linnaeus, 1758
Bethylidae
Bethylidae unplaced sp. TMAG_F103010
Bethylidae unplaced sp. TMAG_F103103
Bethylidae unplaced sp. TMAG_F104854
Bethylidae unplaced sp. TMAG_F47645
Braconidae
Braconinae unplaced sp. TMAG_F95196
Braconinae unplaced sp. TMAG_F95643
Braconinae unplaced sp. TMAG_F96466
Callibracon sp. TMAG_F95195
Chalcididae
Chalcididae unplaced sp. TMAG_F97623
Chrysididae
Chrysididae unplaced sp. TMAG_F103104
Chrysididae unplaced sp. TMAG_F56902
Colletidae
Leioproctus sp. TMAG_F3988
Leioproctus sp. TMAG_F3995
Leioproctus sp. TMAG_F47483
Crabronidae
Bembix furcata Erichson, 1842
Crabronidae unplaced sp. TMAG_F100786
Pison spinolae Shuckard, 1838
Pison westwoodii Shuckard, 1838
Podagritus sp. TMAG_F13427
Rhopalum sp. TMAG_F102407
Sphodrotes sp. TMAG_F99795
Tachysphex unplaced
Evaniidae
Acanthinevania sp. TMAG_F100787
Szepligetiella sp. TMAG_F100790
Formicidae
Amblyopone australis Erichson, 1842
Anonychomyrma biconvexa (Santschi, 1928)
Anonychomyrma nitidiceps (E. André, 1896)
Camponotus claripes Mayr, 1876
Camponotus hartogi Forel, 1902
Camponotus terebrans (Lowne, 1865)
Iridomyrmex sp. TMAG_F101247
Myrmecia forficata (Fabricius, 1787)
Myrmecia fulvipes Roger, 1861
Myrmecia pilosula Smith, 1858
Ochetellus sp. TMAG_F98800
Pheidole unplaced
Polyrhachis patiens Santschi, 1920
Prolasius unplaced
Rhytidoponera tasmaniensis Emery, 1898
Halictidae
Halictidae unplaced sp. TMAG_F101690
Halictidae unplaced sp. TMAG_F101738
Ichneumonidae
Ceratomansa unplaced
Echthromorpha intricatoria (Fabricius, 1804)
Eriostethus unplaced
Heteropelma sp. TMAG_F63139
Ichneumonidae unplaced sp. TMAG_F100134

Ichneumonidae unplaced sp. TMAG_F102418
Ichneumonidae unplaced sp. TMAG_F103003
Ichneumonidae unplaced sp. TMAG_F103115
Ichneumonidae unplaced sp. TMAG_F47672
Ichneumonidae unplaced sp. TMAG_F98739
Netelia unplaced

Megalyridae
Megalyra fasciipennis Westwood in Griffith, 1832

Mutillidae
\+ *Ephutomorpha* sp. TMAG_F103101
Odontomyrme cordatiformis Lelej, 1983

Pompilidae
Ageniellini unplaced
Cryptocheilus australis (Guérin-Méneville, 1838)
Ctenostegus unplaced
Pompilinae unplaced sp. TMAG_F101313
Pompilinae unplaced sp. TMAG_F102510
Turneromyia unplaced

Proctotrupidae
Austroserphus albofaciatus Dodd, 1933

Sphecidae
Podalonia tydei (Le Guillou, 1841)
Prionyx unplaced

Tiphiidae
Anthobosca sp. TMAG_F103102
Thynninae unplaced sp. TMAG_F100934
Thynninae unplaced sp. TMAG_F102757
Thynninae unplaced sp. TMAG_F58807
Thynninae unplaced sp. TMAG_F97082

LEPIDOPTERA (MOTHS AND BUTTERFLIES)

Anthelidae
Anthela cnecias Turner, 1921
Anthela repleta (Walker, 1855)

Carposinidae
Sosineura mimica (Lower, 1893)

Cosmopterigidae
Cosmopterigidae unplaced sp. TMAG_F118048
Cosmopterigidae unplaced sp. TMAG_F118059
Cosmopterigidae unplaced sp. TMAG_F118050
Cosmopterigidae unplaced sp. TMAG_F118051
Cosmopterigidae unplaced sp. TMAG_F118052
Cosmopterigidae unplaced sp. TMAG_F118053
Cosmopterigidae unplaced sp. TMAG_F118054
Cosmopterigidae unplaced sp. TMAG_F118055
Cosmopterigidae unplaced sp. TMAG_F118056
Cosmopterigidae unplaced sp. TMAG_F118057
Cosmopterigidae unplaced sp. TMAG_F118058
Cosmopterigidae unplaced sp. TMAG_F118375
Limnaecia sp. TMAG_F118311
Macrobathra nephelomorpha Meyrick, 1886
Macrobathra sp. TMAG_F118025

Cossidae
Culama australis Walker, 1856
Endoxyla lituratus (Donovan, 1805)

Crambidae
Crambidae unplaced sp. TMAG_F118317
Crambidae unplaced sp. TMAG_F118320
Crambidae unplaced sp. TMAG_F118325
Crambidae unplaced sp. TMAG_F118326
Crambidae unplaced sp. TMAG_F118327
Crambidae unplaced sp. TMAG_F118328
Crambidae unplaced sp. TMAG_F118330
Eudonia sp. TMAG_F118243
Metasia capnochroa (Meyrick, 1884)
Ptochostola microphaeellus (Walker, 1866)
Scoparia plagiotis Meyrick, 1887
Scoparia spelaea Meyrick, 1885

Depressariidae
Depressariidae unplaced sp. TMAG_F118351
Depressariidae unplaced sp. TMAG_F118354
Depressariidae unplaced sp. TMAG_F118355
Depressariidae unplaced sp. TMAG_F118356
Depressariidae unplaced sp. TMAG_F118358
Depressariidae unplaced sp. TMAG_F118359

Elachistidae
Elachista gerasmia (Meyrick, 1889)
Elachista sp. TMAG_F118015
Elachista sp. TMAG_F118016
Elachista sp. TMAG_F118018
Elachista sp. TMAG_F118019
Elachista sp. TMAG_F118020
Elachista sp. TMAG_F118022

Erebidae
Meyrickella ruptellus (Walker, 1863)
Palaeosia bicosta (Walker, 1854)
Paramsacta marginata (Donovan, 1805)
Phaeophlebosia furcifera (Walker, 1854)
Praxis edwardsii Guenée, 1852
Praxis porphyretica Guenée, 1852
Scoliacma adrasta (Turner, 1940)
Spilosoma glatignyi (Le Guillou, 1841)

Gelechiidae
Gelechiidae unplaced sp. TMAG_F118340
Gelechiidae unplaced sp. TMAG_F118343
Gelechiidae unplaced sp. TMAG_F118347
Gelechioidea unplaced
Gelechioidea unplaced sp. TMAG_F118360
Gelechioidea unplaced sp. TMAG_F118361
Gelechioidea unplaced sp. TMAG_F118362
Gelechioidea unplaced sp. TMAG_F118363
Gelechioidea unplaced sp. TMAG_F118368
Gelechioidea unplaced sp. TMAG_F118370

Geometridae
Anachloris subochraria (Doubleday, 1843)
Capusa senilis Walker, 1857
Cassythaphaga petrochroa (Lower, 1897)
Chlorocoma carenaria (Guenée, 1857)
Chlorocoma externa (Walker, 1861)
Chlorocoma vertumnaria (Guenée, 1857)
Cleora sp. TMAG_F107069
Corula geometroides Walker, 1856
Crypsiphona ocultaria (Donovan, 1805)
Cyneoterpna wilsoni (Felder & Rogenhofer, 1875)
Dissomorphia australiaria (Guenée, 1857)
Ectropis fractaria (Guenée, 1857)
Epidesmia hypenaria (Guenée, 1857)
Epyaxa subidaria (Guenée, 1857)

Gastrina cristaria Guenée, 1857
Gastrinodes bitaeniaria (Le Guillou, 1841)
Hydriomenini unplaced *severata* (Guenée, 1857)
Hydriomenini unplaced *trygodes* (Meyrick, 1891)
Hypobapta percomptaria (Guenée, 1857)
Hypobapta tachyhalotaria Hausmann, Sommerer, Rougerie & Hebert, 2009
Idiodes apicata Guenée, 1857
Idiodes siculoides (Walker, 1860)
Melanodes anthracitaria Guenée, 1857
Microdes villosata Guenée, 1857
Nearcha curtaria (Guenée, 1857)
Nisista serrata (Walker, 1857)
Oenochroma vinaria Guenée, 1857
Parosteodes fictiliaria (Guenée, 1857)
Phelotis cognata (Walker, 1860)
Phrissogonus laticostata (Walker, 1862)
Poecilasthena anthodes (Meyrick, 1891)
Prasinocyma semicrocea (Walker, 1861)
Psilosticha attacta (Walker, 1860)
Rhynchopsota delogramma Lower, 1903
Scopula optivata (Walker, 1861)
Scopula rubraria (Doubleday, 1843)
Syneora mundifera (Walker, 1860)
Taxeotis intermixtaria (Walker, 1861)
Taxeotis intextata (Guenée, 1857)

Glyphipterigidae
Glyphipterix sp. TMAG_F118029

Gracillariidae
Acrocercops sp. TMAG_F19850
Gracillariinae unplaced sp. TMAG_F118364

Hesperiidae
Taractrocera papyria (Boisduval, 1832)

Lasiocampidae
Pararguda nasuta (Lewin, 1805)
Pernattia pusilla (Donova, 1805)

Lecithoceridae
Lecithocera terrigena (Meyrick, 1904)

Lyonetiidae
Dascia sp. TMAG-F118377

Noctuidae
Agrotis porphyricollis Guenée, 1852
Diarsia intermixta (Guenée, 1857)
Ectopatria "DPILMbrownshortpecten"
Ectopatria sp. TMAG_F118227
Ectopatria sp. TMAG_F8523
Hadenini unplaced species inquirenda *ligniplena* Walker, 1857
Leucania uda Guenée, 1852
Noctuidae unplaced sp. TMAG_F118234
Noctuinae unplaced sp. TMAG_F118236
Persectania ewingii (Westwood, 1839)
Proteuxoa melanographa (Turner, 1908)
Proteuxoa microspila (Lower, 1902)
Proteuxoa sanguinipuncta (Guenée, 1857)
Proteuxoa sp. nr *flexirena* (Walker, 1865)

Nolidae
Nola albalis (Walker, 1866)

Notodontidae
Epicoma melanospila (Wallengren, 1860)
Hobartina amblyiodes (Turner, 1931)
Neola semiaurata Walker, 1855
Sorama bicolor Walker, 1855

Nymphalidae
Geitoneura klugii (Guérin-Méneville, 1830)
Heteronympha merope (Fabricius, 1775)
Junonia villida Fabricius, 1787

Oecophoridae
Acanthodela erythrosema (Meyrick, 1886)
Agriophara sp. TMAG_F118024
Barea sp. TMAG_F118304
Eochrois callianassa (Meyrick, 1883)
Euchaetis inceptella (Walker, 1864)
Garrha unplaced
Heteroteucha translatella (Walker, 1864)
Oecophorinae genus nr *Atheropla* unplaced
Oecophorinae unplaced sp. TMAG_F118250
Oecophorinae unplaced sp. TMAG_F118253
Oecophorinae unplaced sp. TMAG_F118257
Oecophorinae unplaced sp. TMAG_F118258
Oecophorinae unplaced sp. TMAG_F118260
Oecophorinae unplaced sp. TMAG_F118271
Oecophorinae unplaced sp. TMAG_F118274
Oecophorinae unplaced sp. TMAG_F118276
Oecophorinae unplaced sp. TMAG_F118278
Oecophorinae unplaced sp. TMAG_F118279
Oecophorinae unplaced sp. TMAG_F118283
Oecophorinae unplaced sp. TMAG_F118284
Oecophorinae unplaced sp. TMAG_F118286
Oecophorinae unplaced sp. TMAG_F118287
Oecophorinae unplaced sp. TMAG_F118288
Oecophorinae unplaced sp. TMAG_F118289
Oecophorinae unplaced sp. TMAG_F118293
Oecophorinae unplaced sp. TMAG_F118294
Oecophorinae unplaced sp. TMAG_F118295
Oecophorinae unplaced sp. TMAG_F118296
Oecophorinae unplaced sp. TMAG_F118299
Philobota atmobola Meyrick, 1884
Philobota productella (Walker, 1864)
Stathmopoda chalcotypa Meyrick, 1897
Tortricopsis uncinella (Zeller, 1854)
Wingia group sp. TMAG_F118296
Wingia group sp. TMAG_F118335
Wingia group sp. TMAG_F118336

Opostegidae
Opostega sp. TMAG_F118031

Pieridae
i *Pieris rapae* (Linnaeus, 1758)

Psychidae
Psychidae unplaced sp. TMAG_F107988

Pyralidae
Faveria tritalis (Walker, 1863)
Gauna aegusalis (Walker, 1859)
Pyralidae unplaced sp. TMAG_F118316
Spectrotrota fimbrialis Warren, 1891Sphingidae
Hippotion scrofa (Boisduval, 1832)

Tineidae
Edosa ochranthes (Meyrick, 1893)
Tineidae unplaced sp. TMAG_F118331
Tineidae unplaced sp. TMAG_F118334
Tineidae unplaced sp. TMAG_F118378
Tortricidae
Acropolitis ergophora Meyrick, 1910
Epiphyas postvittana (Walker, 1863)
Epitymbia isoscelana (Meyrick, 1881)
Eucosmini unplaced sp. TMAG_F118043
Olethreutinae unplaced sp. TMAG_F118041
Yponomeutidae
Yponomeutidae unplaced sp. TMAG_F118179
Yponomeutidae unplaced sp. TMAG_F118180
Xyloryctidae
Araeostoma aenicta Turner, 1917
Araeostoma ANIC sp. 01
Xylorycta calligramma (Meyrick, 1890)
Zygaenidae
Pollanisus viridipulverulenta (Guérin-Méneville, 1839)

NEUROPTERA (LACEWINGS AND ALLIES)
Chrysopidae
Apertochrysa edwardsi (Banks, 1940)
Hemerobiidae
Micromus tasmaniae (Walker, 1860)
Mantispidae
Campion unplaced
Myrmeleontidae
Mossega indecisa (Banks, 1913)

ODONATA (DAMSELFLIES AND DRAGONFLIES)
Coenagrionidae
Austroagrion cyane (Selys, 1876)
Ischnura aurora (Brauer, 1865)

ORTHOPTERA (GRASSHOPPERS AND CRICKETS)
Acrididae
Austroicetes vulgaris (Sjöstedt, 1931)
Cryptobothrus chrysophorus Rehn, 1907
Gastrimargus musicus (Fabricius, 1775)
Goniaea australasiae (Leach, 1814)
Macrotona australis (Walker, 1870)
Phaulacridium vittatum (Sjöstedt, 1920)
Schizobothrus flavovittatus Sjöstedt, 1921
Gryllacrididae
Kinemania ambulans (Erichson, 1842)
Tetrigidae
Paratettix argillaceus (Erichson, 1842)
Tettigoniidae
Conocephalus unplaced
Zaprochilus australis (Brullé, 1835)
Trigonidiidae
Bobilla unplaced
Trigonidium albovittata (Chopard, 1951)

PSOCODEA (LICE)
Myopsocidae
Myopsocus sp. TMAG_F104739

THYSANOPTERA (THRIPS)
Phlaeothripidae
Idolothrips spectrum Haliday, 1852

ARANEAE (SPIDERS)
Lycosidae
* *Tasmanicosa godeffroyi* (L. Koch, 1865)
Theridiidae
i* *Latrodectus hasselti* Thorell, 1870
Pisauridae
* *Dolomedes* unplaced

CRUSTACEA: ISOPODA (SLATERS)
Porcellionidae
i *Porcellio scaber* Latreille, 1804

MOLLUSCA: GASTROPODA (SNAILS AND SLUGS)
Bothriembryontidae
Bothriembryon tasmanicus (Pfeiffer, 1853)
Geomitridae
i *Prietocella barbara* (Linnaeus, 1758)

Appendix 1.5: Marine invertebrate taxa of Spring Bay Mill

CRUSTACEA: BRACHYURA (CRABS)
Hymenosomatidae
Halicarcinus innominatus Richardson, 1949
Pilumnidae
Pilumns monilifera Haswell, 1882

CRUSTACEA: ISOPODA (SLATERS)
Ligiidae
Ligia australiensis Dana, 1853

CRUSTACEA: CIRRIPEDIA (BARNACLES)
Balanidae
Austromegabalanus nigrescens (Lamarck, 1818)
i *Balanus trigonus* Darwin, 1854

BRYOZOA (LACE-CORALS)
Arachnopusiidae
Arachnopusia unplaced
Bugulidae
Bugula unplaced
i *Bugulina flabellata* (Thompson in Gray, 1848)
Virididentula dentata (Lamouroux, 1816)
Candidae
Amastigia texta (Lamarck, 1816)
Emma unplaced
Tricellaria inopinata D'Hondt & Occhipinti Ambrogi, 1985
Membraniporidae
i *Membranipora membranacea* (Linnaeus, 1767)
Scruparidae
Scruparia ambigua (D'Orbigny, 1847)
Watersiporidae
Watersipora subtorquata (D'Orbigny, 1852)

Vesiculariidae
Amathia unplaced
Actiniaria unplaced

CNIDARIA: ANTHOZOA (ANEMONES)
Actiniidae
* *Actinia tenebrosa* Farquhar, 1898
Anthothelidae
Erythropodium hicksoni (Utinomi, 1971)
Corallimorphidae
Corynactis australis Haddon & Duerden, 1896

CNIDARIA: HYDROZOA (HYDROIDS)
Plumulariidae
Plumularia unplaced

CHORDATA: TUNICATA (SEA-SQUIRTS)
Ascidiidae
i *Ascidiella aspersa* (Mueller, 1776)
Styelidae
Asterocarpa humilis (Heller, 1878)
Botrylloides perspicuus Herdman, 1886
Polycarpa unplaced

MOLLUSCA: BIVALVIA (CLAMS)
Cleidothaeridae
* *Cleidothaerus albidus* (Lamarck, 1819)
Cyamiidae
* *Perrierina bernardi* (Tate & May, 1901)
Hiatellidae
Hiatella australis (Lamarck, 1818)
Montacutidae
* *Mysella donaciformis* Angas, 1878
Mytilidae
* *Brachidontes erosus* (Lamarck, 1819)
i *Mytilus galloprovincialis* Lamarck, 1819
Ostreidae
*i *Magallana gigas* (Thunberg, 1793)
Ostrea angasi G. B. Sowerby II, 1871
Psammobiidae
* *Hiatula biradiata* (Wood, 1815)
Pteriidae
Vulsella ovata Lamarck, 1819
Tellinidae
* *Macomona deltoidalis* (Lamarck, 1818)
Veneridae
* *Eumarcia fumigata* (G. B. Sowerby II, 1853)
* *Irus carditoides* (Lamarck, 1818)
* *Katelysia rhytiphora* (Lamy, 1935)
* *Katelysia scalarina* (Lamarck, 1818)
* *Notopaphia grisea* (Lamarck, 1818)

MOLLUSCA: CEPHALOPODA (CUTTLEFISH)
Sepiidae
* *Sepia apama* Gray, 1849

MOLLUSCA: POLYPLACOPHORA (CHITONS)
Chitonidae
Sypharochiton pelliserpentis (Quoy & Gaimard, 1835)

MOLLUSCA: GASTROPODA (SNAILS AND SLUGS)
Batillariidae
* *Zeacumantus diemenensis* (Quoy & Gaimard, 1834)
Chromodorididae
Ceratosoma brevicaudatum Abraham, 1876
Columbellidae
* *Anachis atkinsoni* (Tenison-Woods, 1876)
* *Mitrella leucostoma* (Gaskoin, 1852)
Dialidae
* *Diala suturalis* (A. Adams, 1853)
Fasciolariidae
* *Australaria australasia* (Perry, 1811)
Haliotidae
* *Haliotis rubra* Leach, 1814
Litiopidae
* *Alaba monile* A. Adams, 1862
Littorinidae
* *Afrolittorina praetermissa* (May, 1909)
* *Austrolittorina unifasciata* (Gray, 1826)
Lottiidae
* *Patelloida alticostata* (Angas, 1865)
Muricidae
Agnewia tritoniformis (Blainville, 1832)
Nacellidae
* *Cellana solida* (Blainville, 1825)
Nassariidae
* *Nassarius pauperatus* (Lamarck, 1822)
* *Nassarius pyrrhus* (Menke, 1843)
Neritidae
* *Nerita melanotragus* E. A. Smith, 1884
Pyramidellidae
Turbonilla mariae Tenison-Woods, 1876
Phasianellidae
* *Phasianella australis* (Gmelin, 1791)
Ranellidae
* *Cabestana spengleri* (Perry, 1811)
* *Charonia lampas rubicunda* (Linnaeus, 1758)
* *Cymatiella verrucosa* (Reeve, 1844)
Siphonariidae
* *Siphonaria diemenensis* Quoy & Gaimard, 1833
* *Siphonaria funiculata* Reeve, 1856
Triphoridae
Costatophora granifera (Brazier, 1894)
Trochidae
* *Austrocochlea brevis* Parsons & Ward, 1994
* *Austrocochlea constricta* (Lamarck, 1822)
* *Diloma concameratum* (W. Wood, 1828)
Turbinidae
Lunella undulata (Lightfoot, 1786)

Appendix 1.6: Incidental observations of vertebrate taxa at Spring Bay Mill

BIRDS

Acanthiza pusilla (Shaw, 1790)
Anas superciliosa Gmelin, 1789
Anthochaera chrysoptera (Latham, 1801)
Anthochaera paradoxa (Daudin, 1800)
Aquila audax (Latham, 1801)
Artamus cyanopterus (Latham, 1801)
i *Carduelis carduelis* (Linnaeus, 1758)
i *Carduelis chloris* (Linnaeus, 1758)
Chrysococcyx lucidus (Gmelin, 1788)
Colluricincla harmonica (Latham, 1801)
Coracina novaehollandiae (Gmelin, 1789)
Corvus tasmanicus Mathews, 1912
Cracticus torquatus (Latham, 1801)
Cuculus pallidus (Latham, 1801)
Gymnorhina tibicen (Latham, 1801)
Haematopus longirostris Vieillot, 1817
Haliaeetus leucogaster Gmelin, 1788
Hirundo neoxena Gould, 1843
Hirundo nigricans (Vieillot, 1817)
Larus novaehollandiae (Stephens, 1826)
Manorina melancephala (Latham, 1801)
Pardalotus striatus (Gmelin, 1789)
i *Passer domesticus* (Linnaeus, 1758)
Phalacrocorax fuscescens (Vieillot, 1817)
Phaps chalcoptera (Latham, 1790)
Rhipidura fuliginosa (Sparrman, 1787)
Strepera versicolor (Latham, 1801)
i *Sturnus vulgaris* Linnaeus, 1758
Thalasseus bergii (Lichtenstein, 1823)
i *Turdus merula* Linnaeus, 1758
Zosterops lateralis (Latham, 1801)

FROGS

Limnodynastes dumerilii Peters, 1863

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